



*Design Compatibility Standards* : *Davis - Monthan*  
: *Air Force Base*  
: *Tucson, Arizona*



*Published January 1998*

*DESIGN COMPATIBILITY STANDARDS*

## *EXECUTIVE SUMMARY*

The following design compatibility standards outline a consistent level of quality and style for all facilities at Davis - Monthan Air Force Base. These standards provide a reference for everyone involved in base design, construction and planning.

Davis - Monthan Air Force Base is located Pima County, Arizona within the city limits of Tucson, in a high altitude, desert environment. Responding to this harsh climate, many buildings on base are influenced by traditional Southwestern desert architecture, using courtyards, thick walls, deeply recessed windows, wide overhangs, trellis and other shading devices. Existing architectural influences off base are minimal.

The Davis - Monthan style will continue to reflect this Southwest influence: horizontal emphasis in building massing and fenestration, simple, rectangular volumes, low sloped roofs, earthtone masonry, metal roofing, and use of various traditional and non-traditional shading elements.

This report identifies design and planning compatibility standards for four zones: Mission, Mission Support, Family Housing and the AMARC (Areospace Maintenance and Regeneration Center). These standards

take into account the primary function of each zone, and also identify base-wide design standards will help to create a consistent image for the base as a whole.

Davis - Monthan has initiated efforts aimed at the comprehensive planning of future base facilities and needs. The Davis - Monthan General Plan deals with broad-scope planning issues. The Vision 2020 AMARC Long-Range Master Plan, the Davis - Monthan AFB Landscape Development Plan, and the Military Family Housing Master Plan are focused on issues that will affect the long term physical development of the base. In addition to these planning documents Davis - Monthan maintains standard architectural and engineering details used at the base, which are available to the design team as computer files. These standards should be used in conjunction with, and complement the intent of these existing, active planning documents and detail standards.

All facilities are now required to meet Force Protection Requirements for anti-terrorism. In addition, all designs must meet the requirements of: the Uniform Building Code (UBC); the Americans with Disabilities Act Accessibility Guidelines (ADAAG), Uniform Federal Accessibility

Standards (UFAS) and Air Combat Command (ACC) Architectural and Interior Design Standards.

These Design Compatibility Standards must be used by all individuals involved in base planning, design and construction. The success of any design standard is dependent upon implementation and enforcement. It is the responsibility of each design professional working at Davis - Monthan to adhere to the design framework presented in these guidelines. Perhaps more importantly, it is the responsibility of the reviewing agencies, particularly at the base level, to enforce the guidelines. Without a collective commitment to understand and enforce the guidelines, achievement of the aesthetic goals desired at ACC facilities is unlikely.

All tenant units at Davis - Monthan AFB are required to comply with the architectural, landscape, exterior signage and engineering sections of this document.

Any deviations from the standards listed in this document must be approved by the Base Architect, ACC Command Architect or the activity project manager noted in each section. Waivers to these standards may be requested through the Base Chief Engineer.



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## BASE MISSION

### HISTORY

Davis - Monthan Air Force Base was Tucson's second recorded airfield. Constructed in accordance with U.S. Army guidelines, on October 6<sup>th</sup>, 1925 the Army declared the base suitable for military operations. The Tucson landing field was dedicated by Charles Lindberg on September 27, 1927 in honor of two Tucsonans - Lieutenant Samuel H. Davis and Lieutenant Oscar Monthan - both of whom died in aerial accidents while serving in the U.S. Army. In April of 1941 the 31<sup>st</sup> Air Base Group became the first unit stationed at the field and on December 3, 1941 the field was officially named Davis-Monthan Field. Davis-Monthan's two bombardment units shipped out shortly after the Japanese attack on Pearl Harbor thus entering World War II. For the remainder of the war

the primary mission of the base was the training of B-24 and B-29 bomber crews. After the war Davis-Monthan served as a separation center, processing soldiers for their return to civilian life. The base also served as a storage base for excess bombers and cargo planes. This mission continues today in the form of the Aerospace Maintenance and Regeneration Center.

The U.S. Air Force took control of the installation on January 13<sup>th</sup>, 1948 and officially renamed it Davis-Monthan Air Force Base. During the 1950's the base was primarily home to several B-29 bomber groups. The 1960's brought Titan II missiles and U-2 reconnaissance aircraft, and in 1964 the base began training air crews for the new F-4 Phantom fighter, at the time the nation's most advanced fighter. In 1971 the 355<sup>th</sup> Tactical Fighter Wing located at Davis-Monthan, flying A-7 Corsairs and later A10-A

Thunderbolts. This marked a shift from a strategic to a more tactical mission. By the end of 1971 the 355<sup>th</sup> assumed host unit duties and command of the base switched from Strategic Air Command to Tactical Air Command. In 1981, after about a decade under the 355<sup>th</sup> the 836<sup>th</sup> Air Division assumed host unit responsibility. Their tenure as host unit also lasted about a decade when, due to Air Force downsizing, the 836<sup>th</sup> was deactivated. In May of 1992 the 355<sup>th</sup> resumed host duties, which it continues to perform as an Air Combat Command base.

### BASE COMPONENTS

The 355<sup>th</sup> Wing is composed of the 355<sup>th</sup> Operations Group, the 355<sup>th</sup> Logistics Group, the 355<sup>th</sup> Support Group, the 355<sup>th</sup> Medical Group and the 355<sup>th</sup> Comptroller Squadron. The 355<sup>th</sup> provides base operations, logistical and administrative support to all personnel



and units on the base.

The major associate units at Davis - Monthan include the Aerospace Maintenance and Regeneration Center (AMARC) and Headquarters 12<sup>th</sup> Air Force.<sup>1</sup>



*Mission*

*The mission of the 355<sup>th</sup> Wing is to “provide close air support, forward air liaison for Army forces, command and control, radar surveillance and control, and combat support forces to unified CINCs. Conduct initial and requalification training for all OA-10 and EC-130 pilots and crews. Ensure INF, START, Chemical Weapons Convention and Open Skies treaty compliance.”*

*1) Davis - Monthan Air Force Base Installation Guide and Telephone Directory, pp. 27, 28; Benchmark Publications, Inc., 1977*

## ***THE DAVIS - MONTHAN STYLE***

**T**he Davis - Monthan style, as endorsed in the following pages is a clear response to issues of place and function at Davis - Monthan AFB.

### ***PLACE***

**T**he influence of the Sonoran Desert is clearly evident in both climate and architecture at Davis - Monthan. Borrowing from their adobe predecessors, structures adhering to the Davis - Monthan style rely on design to respond to climate. Thick masonry walls provide thermal mass. Broad overhangs and trellis structures provide shade. Deep recesses shade window openings, reducing heat gain. Shaded courtyards and ramadas provide attractive outdoor spaces for people, sheltered from sun and wind.

Aesthetic responses to the landscape also distinguish the Davis - Monthan style. Earthtone masonry surfaces and sloped roofs blend well with the color and character of the desert and mountains. A horizontal emphasis in building massing, fenestration and site walls reflects and reinforces the broad, horizontal character of the landscape.

Whether due to site and climatic response, or deliberate design reference, buildings in the Davis - Monthan style should and do reflect the spirit of traditional Southwestern desert architecture.

### ***FUNCTION***

**D**avis - Monthan is an intense working environment. Efficient function, low maintenance, and economy are, appropriately, high priorities in such an environment. This manifests itself in both building massing and material selection. Structures are primarily simple in form and rectangular in plan. Roofs are sloped to drain water efficiently.

Split face concrete masonry units (CMU) for exterior walls and standing seam metal roofing are durable and practically maintenance free. While functionally and economically desirable, this approach also responds positively to the aesthetic character of the place.

Considerations of function and place extend to site treatment. The Davis - Monthan style relies on a low maintenance, low water, xeriscape approach to landscaping. While not all plant material is native Sonoran Desert flora, the xeriscape approach visually complements the desert landscape and the architecture without requiring extensive maintenance.

Due to functional requirements, some structures on base will not conform strictly to the Davis - Monthan style. Particularly in the Mission zone, function and economy

will at times override considerations of design compatibility. When a building clearly cannot conform to the standards in total, the designer should understand the individual characteristics that define the style and include appropriate elements in the design to maximize design compatibility.

Waivers to design standards need to be obtained through the Base Chief Engineer.

The following pages outline in more detail the specific elements that, when used consistently, assure a cohesive built environment and define the Davis - Monthan style.



*A*





B



C

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

- PRIMARY CHARACTERISTICS
- Simple, rectangular plan and massing
- Earthtone split face or ribbed CMU exterior walls
- Deeply recessed window openings
- Sloped, standing seam metal roofs with broad, shading, overhangs
- Horizontal emphasis
- Exterior trellis and ramada structures
- Xeriscape approach to landscaping

- A. Trellised entry with split face CMU and xeriscaping.
- B. Dormitory with broad, shading overhang and horizontal massing emphasis. (Building 4220)
- C. Deeply recessed window in split face CMU wall.

## REGIONAL SETTING

### GEOGRAPHIC

Davis - Monthan Air Force Base is located on 10,633 acres in Pima County within the city limits of Tucson, the Pima County seat. The base is easily accessible via Interstate routes 10 and 19. Interstate 10, the major east-west artery serving Tucson, passes just west of Davis - Monthan while Interstate 19 is the major link between Tucson and the Mexican border.

### CLIMATIC SETTING

Davis - Monthan's desert environment, combined with its high altitude (2,550 to 2,900 feet above sea level) creates an ideal environment for flight functions and aircraft storage, as well as for outdoor recreational activities. Mild year-round, the region averages more than 300 days of sunshine and only 12 inches of rainfall annually. The most concentrated rain occurs in the months of July and August in the form of afternoon thunderstorms. The two months average about 15 days of showers. In summer, the average low temperature is 73 degrees and the average high is 98. Winter lows average 41 degrees with a high of 65. The area averages 138 days with temperatures in excess of 90 degrees and 19 days with temperatures below 32 degrees.<sup>1,2</sup>

Prevailing winds are typically 6-8 knots, direction as follows:

9 AM - 11 AM	Southeast
11 AM - 7 PM	Northwest
7 PM - 11 PM	Southeast

Maximum sun angles range from approximately 81 degrees in summer to 33 degrees in winter. Because of the high summer temperature range, the limited natural shade and the high percentage of sunny days, solar control is a high priority on any project designed for Davis - Monthan.

### GEOLOGICAL SETTING

The Tucson area is situated on a high valley floor in the midst of five mountain ranges - the Santa Catalinas, the Santa Ritas, the Sierritas, the Rincons and the Tucson Mountains. Davis - Monthan AFB is situated in this valley floor near the center of the Tucson Basin. Surface soils on the base consist of silts, clays, sands and gravels. Subsurface soils consist largely of clays, rocks and caliche type soils, typically rock-like in nature. While an ideal surface for outdoor aircraft storage, the caliche is problematic for building construction. Difficulty in excavation and potentially uneven foundation support conditions can result in increased construction costs.<sup>2</sup>

Vegetation native to Davis - Monthan consists of grasses, cactus and scrub indigenous to the Sonoran Desert. Vegetation in developed portions of the base is largely imported non-native flora, artificially irrigated.

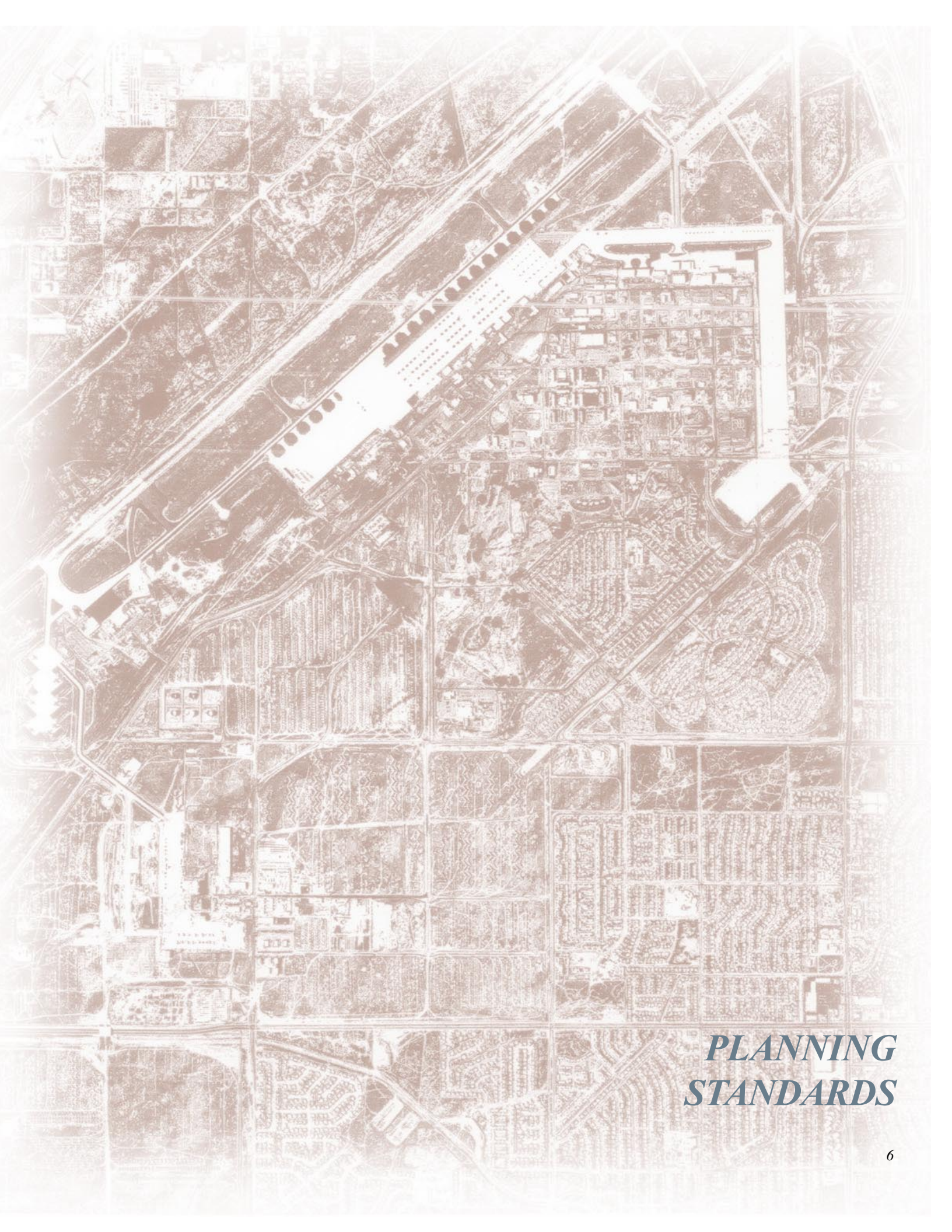
While not inhospitable, Davis - Monthan exists in a desert environment. Conditions are harsh in both geologic and climatic terms. Site specific design is mandatory. It is imperative that design professionals working in this environment recognize and respond to the specific conditions that exist at Davis - Monthan.



1) Davis - Monthan Air Force Base Installation Guide and Telephone Directory, pp. 61, Benchmark Publications, Inc., 1977

2) Davis - Monthan AFB - The General Plan, A Planning Summary document, pp 4.A-2, 4.A-3, 4.A-5, Higgenbotham / Briggs and Associates, Colorado Springs, Colorado





# *PLANNING STANDARDS*



## ZONING

Davis - Monthan AFB is currently segregated into four distinct functional zones. These zones are illustrated on the Zoning Map, Appendix A, at the end of this document and are further described below.

### ZONE 1 - MISSION

The “Mission” zone includes areas directly related to the operation and maintenance of aircraft. This includes hangars and runways as well as maintenance, storage and supply functions. This irregularly shaped zone extends north of Arizola Street, roughly to the southwest of First and Yuma Streets.

### ZONE 2 - MISSION SUPPORT

The “Mission Support” zone includes areas designated as commercial activity, club facility, indoor recreation, and community service. Also included in this zone are structures housing administrative services related to a wide range of base operations. At Davis - Monthan, dormitory style unaccompanied housing occurs within this zone as well.

This zone is bounded by Yuma and First Streets to the west and southwest, Arizola Street to the north and Craycroft Road and Tenth Street to the east. The 12th Air Force Headquarters is included in this

zone.

### ZONE 3 - FAMILY HOUSING

The “Family Housing” zone includes areas designated primarily for single family housing for both unaccompanied and accompanied personnel. The zone occupies the area bounded by the golf course to the south, Golflinks and Wilmot Roads to the North and East and Eleventh Street, roughly, to the west.

### ZONE 4 - AMARC ZONE

The AMARC (Aerospace Maintenance and Regeneration Center) zone is unique to Davis - Monthan AFB. Occupying some 2,600 acres, AMARC - also referred to as “The Boneyard” - is home to over 5,200 stored aircraft. AMARC is a major industrial center, providing storage, regeneration, reclamation and disposal capabilities for a wide range of aircraft and aerospace items. AMARC occupies the north/central portion of the base.

Throughout the base structures exist that do not fit the zoning categories as described herein. Administrative support functions serving specific hangar buildings are located in the Mission zone. Likewise, dormitories are located in the Mission Support zone rather than in the Family Housing

zone. Complete adherence to the zones is impossible in an environment as functionally complex as Davis - Monthan. Care must be taken in these cases to assure that *architectural* compatibility is maintained within specific zones despite varying building functions.

Some positive *base-wide* aesthetic trends have emerged in recent construction. Addressing all zones, these aesthetic characteristics help create a harmonious, consistent image for the entire base. Continuation of these trends in future development will further reinforce the image of the base as a cohesive whole. Functional requirements will, however, lead to architectural treatments that are *zone-specific*. Aircraft hangars are required to be large and industrial in character and merit little, if any, landscape treatment. In contrast, a child development center should be small in scale and friendly in character. Only by recognizing the architectural impact that the various functions have on buildings, and continuing to group buildings with similar mission and functional requirements, can functional and aesthetic conflict be minimized and visual cohesiveness maximized.

Both base-wide and zone-specific standards are outlined in this manual.



A





B



C



D



E

A. Although facing the flightline in Zone 1, this building is more characteristic of Zone 2, Mission Support buildings. (Building 4859)

B. Typical metal building hangar complex in Zone 1.

C. Dormitories in Zone 2.

D. Family housing zone in Zone 3.

E. A combination of split face and ribbed CMU, and standing seam metal roofing in Zone 4.

## BUILDING SITING

### CURRENT

Building siting at Davis - Monthan is at present, primarily functionally driven. While compatible groupings of buildings have traditionally been located in proximity to one another (flight line structures, dormitories, etc.), concern with site aesthetics, green space development and pedestrian friendly design has been the exception rather than the rule.

Newer structures on the base exhibit a more campus-like approach to site design. Visual shielding of parking and utilities, enhanced pedestrian environments, and climate- and topography-appropriate design are evident even in the flight line and AMARC zones. The landscaped plaza on the flight line side of Building 4859 represents a good example of aesthetic and pedestrian response in a mission environment.

While the activities in zones 2 and 3 lend themselves more naturally to the "campus" character desired, the same site design guidelines can - and should - be applied to projects in zones 1 and 4. While functional site design factors will be given top priority at Davis - Monthan, pedestrian response and connectivity with neighboring buildings should also be a driving factor on all new projects.

### GENERAL STANDARDS

Avoid small sites that cause problems for neighboring buildings and unnecessarily drive up costs.

Site buildings with a common function (such as dormitories) in proximity to each other. In addition to sharing common infrastructure, the massing, scale, materials and details can be used to link the buildings aesthetically.

Provide enough space around a complex for expansion. Assume 10% for expansion whenever other supporting data is not available.

When existing traffic patterns will be altered by new construction, provide adequate traffic alternatives to coincide with the construction of the project.

Locate buildings in a manner that provides easy, direct pedestrian access among buildings in a complex. Only encourage driving when walking cannot be accommodated.

Do not use sites that force building functions into basements, third floors or uneconomical shapes such as curves, diagonals or long rectangles.

Use sites that allow open landscape space around buildings to separate them from the pavement. Prevent an overcrowded appearance.

Buildings shall be sited to establish a minimum of 5 percent ground slope away from the building for a minimum of 10 feet. Establish floor elevations at a minimum of 6 inches above any surrounding terrain within 10 feet of the building. Site buildings to capitalize on existing topography when possible.

Use existing or natural grades and contours to develop positive drainage away from buildings, thereby avoiding excessive cut and fill.

Minimum building setback from streets and roads shall be sixty feet from the street centerline unless otherwise approved by the project manager. Building setbacks should vary no more than ten percent from the average setback of adjacent buildings. Setback distance in the family housing zone should be consistent with individual housing groups. Building setbacks shall include all components of the building including mechanical yards, screen walls, porches, etc.



A



DESIGN COMPATIBILITY STANDARDS



*B*

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA



*D*



*C*

*A. Grouped dormitories.*

*B. Paved paths, landscaping and lighting encourage pedestrian circulation between buildings in a functional complex. (Building 4859)*

*C. Unacceptable! Tight site allows no landscape space around building.*

*D. Acceptable. Site buildings to provide landscape space between building and paving.*







*CIVIL  
STANDARDS*



## STREETS/PAVING

### CURRENT

Main Roads at Davis - Monthan run primarily in an east-west and north-south grid pattern. Of the base's primary roads, only Quijota Road, Yuma Street and Phoenix Avenue vary from this pattern. Paralleling the main runway, these roads run on a northwest-southeast axis. In Zone 3 roads exhibit a serpentine pattern with several cul-de-sacs, typical of suburban neighborhood street planning. See "Primary and Secondary Streets" map, Appendix B, at the end of this document for street layout.

Three main arteries, radiating from base gates, serve Davis - Monthan. Craycroft Road runs south from the Main Gate to the flight line area. The Sunglow Road/5<sup>th</sup> Street artery originates at the Swan Gate and terminates at Phoenix Street. These primary roads serve Zones 1 and 2. The third primary artery, Arizola Street and Quijota Road to Wilmont, serves all four zones and is the primary east-west connector on base.

Secondary streets serving Zone 1 are First and Phoenix Streets. Zone 2 secondary streets include Third, Comanche, Ironwood, Phoenix Yuma and Pichacho Streets. Ironwood also connects Zone 2 to Zone 3, Family Housing. Serving the

AMARC area are Coolidge Street, Irvington Road and Safford Avenue.

Signs of wear are present on roads in older areas of the base. In general though, roads at Davis - Monthan are in excellent condition. Roadways are typically well maintained, well marked and almost all have curb and gutter.

Street edge treatment at Davis - Monthan varies greatly. At some locations within the dormitory area, streets are extensively landscaped on one side with decomposed granite groundcover, low and medium height plant material and areas of large river rock. On the opposite side of the same street, however, the curb and gutter simply edges unimproved areas of soil and patchy grasses. This appears to result from delayed or unequal implementation rather than a lack of streetscape policy.

Consistent treatment of street edges can be identified at individual locations basewide. Along Craycroft Road a combination of gravel groundcover and medium river rock works well with a formal, palm lined concrete sidewalk to visually identify Craycroft as a primary boulevard. Along the flight line boundary on Yuma Street, the same gravel and river rock are used, here in combination with a low site wall and

low level plant material. This street edge treatment effectively identifies the flight line zone boundary.

The same decomposed granite and river rock, combined with medium height and taller plant material, identifies and punctuates parking lot entrances at several dormitories. This consistent use of street edge landscape material in appropriate but varying fashions contributes to the basewide visual harmony desired at ACC facilities.

### GENERAL STANDARDS

All street edge improvements should conform to guidelines outlined in the Landscape Standards of this document. Refer to Landscape Development Plan, May 1996 for applicable areas. Refer to the Civil Standards section of this document for sidewalk and curb and gutter standards.



A  
13



B  
DESIGN COMPATIBILITY STANDARDS

Intersections of roads or streets shall be no closer together than 150 feet. All street intersections shall be 90 degree unless otherwise approved by Base Civil Engineer. All new street and road intersections shall have new survey monuments installed as per base standard details.

At major intersections and major parking lot entries punctuated by landscape applications, limit landscaping and site walls within 50 feet of intersections and major entrances to 3 feet in height to ensure minimum 100 foot unobstructed views of traffic. No site walls, shrubs or trees that may obstruct views should occur within 20 feet of any road intersection. Refer to Department of Defense standards for exact view requirements.

Minimum pavement slope, to ensure drainage, shall be 0.60% for asphaltic

concrete and 0.40% for portland cement concrete.

All new portland cement concrete (PCC) pavement joints shall be sealed using preformed neoprene compression seals installed per the manufacturers' instructions. All existing PCC joints shall be sealed using pourable joint sealant. See base standard details.

Airfield joint sealant shall be jet fuel resistant.

All traffic signs and pavement markings shall conform to the Manual on Uniform Traffic Control Devices (MUTCD).

Standard specifications for pavement and landscape design can be obtained from the Civil Engineering Design section at Davis - Monthan AFB. These specifications shall be used in their entirety or in part as appropriate. Changes to the specifications must be approved by the Civil Engineering Design Section.



C



D



A. Craycroft Road streetscape.

B. Masonry site wall and xeriscaping along Yuma Street.

C. Typical residential streetscape

D. Landscape placement allowing unobstructed visibility at the intersection of Craycroft Road and Ironwood Street.

## PARKING

### CURRENT

Surface parking lots are treated in a variety of fashions, both good and bad, at Davis - Monthan. The dormitory area has perhaps the highest parking demand on base. By locating the bulk of the parking in the space between buildings and by using landscape screening along the road edge, the visual impact of surface parking is minimized on the street.

Less sensitively handled, at the Self-Help Center (Building 5303), parking is stretched completely across the building's front rather than pulled to the side. Not only does this create a serious pedestrian hazard, its location completely blocks the building entry, visually and functionally. Cars overwhelm the view toward the building.

### GENERAL STANDARDS

Do not locate parking directly in front of a building or entrance. Do not locate parking between a main viewing street and a building. If possible, parking should be located behind the building it serves. In no case should parking be designed "on-street".

Along major street edges parking should be screened from public

rights of way and adjacent buildings by approved landscaping, berms or masonry site walls.

Design sites to limit walking distance from parking lot to building to 200 feet. For transient and bachelor housing, limit luggage carrying and walking distance to 100 feet.

Use separate parking lots accommodating 50 cars or fewer rather than single lots accommodating 200 cars or more. Where large parking lots exist or are required by functional layout, landscape approximately 10 percent of the lot. Screen lots and break up large expanses of pavement with planting islands and buffer strips.

Parking lots shall have minimum 20 foot buffers between edge of lot and building or road.

Angle of parking and stalls in high density, low turnover areas shall be ninety degrees. In medium and high turnover areas, sixty degree parking is preferred. Forty-five degree angle parking shall not be used.

Parking areas should contain both normal and handicap stalls with 24 foot driving lanes. Standard stall size shall be 20x10 feet. Minimum size shall be 19x9 feet. Handicap stalls shall be standard stalls with a 5 foot common area between stalls, or an

expanded stall, minimum size 12x18 feet. Handicap access ramps shall be constructed into concrete curb and sidewalk.

All parking lots shall be striped and signed. No raised, pole mounted parking signs shall be permitted. All parking signs ("Visitor Parking", "Handicap Parking", etc.) shall be curb mounted with horizontally slotted screw holes or other provisions for expansion.

Zone 3 parking should allow for an average of 1.5 spaces of off-street parking per unit. Additional parking should be accommodated through the use of strategically placed banks of parking perpendicular to the street. On street parking is not included in required parking counts.



A



B





C



D



E

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

- A. Curb mounted parking lot sign
- B. Unacceptable! Do not locate parking directly in front of buildings
- C. Avoid large uninterrupted expanses of parking
- D. Landscaped buffer zones provide screening and shade
- E. Planting islands break up large expanses of paving and provide shading

## SITE LIGHTING

### CURRENT

Site lighting at Davis - Monthan has been approached on a project specific basis rather than as a basewide issue. Building, parking lot and street lighting varies from site to site. Recent construction efforts - such as the Twelfth Air Force Headquarters facility and the lighting at the intersection of Craycroft and Ironwood - incorporate a similar lighting palette. This palette begins to define the architectural character sought at Davis - Monthan and to reinforce the basewide visual harmony sought.

### GENERAL STANDARDS

All exterior lighting shall comply with the City of Tucson Lighting Ordinance 6786.

Exterior building lights shall be fluorescent fixtures. All street, site, plaza, etc. lighting shall be high pressure sodium.

All poles shall be square, straight aluminum. For mounting heights over 35 feet, a square steel pole, tapered toward the top, shall be used.

Luminaires and poles shall be anodized or duranodic bronze aluminum or matching color bronze painted steel finish with appropriate NEMA distribution for its intended function.

All luminaires shall be rectilinear. Cobra head fixtures are acceptable at remote roadway locations only. Roadway luminaires shall be arm mounted.

Average mounting heights shall be as follows:

- Sidewalk and plaza lighting - 12 to 50 feet
- Special purpose lighting - 20 to 30 feet
- Parking and roadway lighting - 30 to 50 feet

Selection of poles and fixture types for specific functions should be consistent throughout the base.

Lighting levels and installations should vary with the volume and type of traffic and the visual character desired.

Coordinate street lighting and sidewalk lighting locations with site amenities (landscaping, benches, signs, etc).



A



B



C





D



E

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

- A. Integrated street and traffic light unit at the intersection of Craycroft Road and Ironwood Street.
- B. Cobra head street lighting.
- C. Rectilinear parking lot lighting on square pole.
- D. Typical bollard lighting. (Building 4859)
- E. Rectilinear area lighting. (Building 5426)

## SIDEWALKS/CURB AND GUTTER

### CURRENT

Sidewalks and curb and gutter installation at Davis - Monthan appear to be in fairly good condition basewide. The use of sidewalks and curb and gutter at Davis - Monthan should be considered mandatory.

### GENERAL STANDARDS

Within pedestrian use areas, sidewalks shall be installed at all parking lots and along at least one side of each street.

Sidewalks shall be a minimum of 4 feet wide. A minimum 5 foot wide landscaping strip should be incorporated between the edge of curb and the edge of sidewalk when used along primary roads. Sidewalks along secondary roads do not require landscaping strips. In zone 3 sidewalks should occur on both sides of the street.

Portland cement concrete (PCC) curb and gutter shall be used on all parking lot paving and all streets except in non-containment areas of the base. Curbs shall be a minimum of 6 inches high. Gutters shall be a minimum of 21 inches wide. Drainage should be along the curb. PCC curb without gutter is acceptable where drainage does not flow at perimeter.

All parking lots shall be curbed and shall be designed to drain along perimeter curb and gutter. Where runoff is required to flow to the center of a lot, a portland cement concrete gutter shall be used and shall be approved by Base Civil Engineer.

All patches in asphalt paving cut for utility installations shall be underlain with portland cement concrete.



A



C

A. PCC curb and gutter with ADA accessible curb cut and ramp.

B. Sidewalk with landscape strip bordering Craycroft.

C. PCC parking lot curb without gutter.



B



## ACC LANDSCAPE DESIGN POLICY SYNOPSIS

**L**andscape planning creates an attractive environment that promotes the well being of the people who live and work within it. The landscape design provides both a practical solution and an aesthetic statement. As a practical solution, the design supports the functions of the installation and improves environmental quality; it designates areas for different uses, provides privacy, screens unsightly areas, reduces wind velocities, provides shade, assists in dust and erosion control, aids in noise abatement, directs pedestrian and vehicular movement and reduces maintenance requirements. As an aesthetic statement the design also helps to preserve and enhance the quality of base life and the exciting landscape resources; it includes elements of human scale, adds color and texture, provides a balance between vertical and horizontal lines, and improves visual quality.<sup>1</sup>

*1) - Community Forestry Master Plan  
Nebraska Forest Service, Department of Forestry,  
Fisheries and Wildlife - University of Nebraska- Lincoln  
November, 1978*

**I**n the spirit of overall visual harmony, simplicity and minimal maintenance by design (see ACC design policy statement on page 28) ACC policy suggests the following as general landscape guidelines applicable to all ACC bases.

*“All landscaping should comply with the base land management plan. Develop functional rather than purely visual landscapes and pre-plan to reduce maintenance. Provide a landscaped space uncluttered by vehicles in front, at the entrance, and between the viewing street and the entrance.”*

**Mowing Strips -** Provide planting beds

with wide mowing strips such as 4 inch thick by 12 inch wide concrete. Mowing strips should eliminate hand trimming and edging caused by turf creeping into bedding plants.

**Plant Material -** Use indigenous, low maintenance, adapted trees and shrubs recommended for urban or street use that can survive without irrigation after the first season (one year) warranty maintenance period. Do not use plant material that drops large amounts of fruit or seed pods. Select deciduous trees that drop their leaves early in the fall season rather than those that retain brown leaves most of the winter and continue to be a maintenance problem

for many months. Some trees to avoid are sycamore, beech and some oaks.

**Surface runoff -** Use trees, shrubs, grass and landscaping to reduce stormwater runoff. Terrace steep slopes. Berms - Use berms to screen and restrict views. Limit berm slopes to 1 foot in 10 feet. Do not use earth berms against building walls.

**Function -** Use landscape to reduce energy costs; shade to prevent heat and glare, wind breaks to lessen air infiltration. Use landscape to screen unsightly views, control pedestrian circulation and define entries.

**Landscape guidelines specific to Davis -** Monahan are outlined on the following pages.

## LANDSCAPE DESIGN STANDARDS



## LANDSCAPE PLANNING

### CURRENT CONDITIONS

Many successful landscape installations are found throughout Davis - Monthan AFB. Much care has been taken to establish a basewide landscaping theme using plant materials which thrive in the climatic constraints of this arid region. 100 degree plus temperatures are not uncommon at Davis - Monthan.

Previous landscape design planners have been moderately successful in providing an overall continuity of landscape materials. Few public areas on base are completely devoid of landscaping. Although the base has plenty of examples of high maintenance, water intensive planting installations, the most positive landscape design direction at Davis - Monthan is an indigenous xeriscape approach. Far superior in terms of water consumption, ease of maintenance and compatibility with native flora, xeriscaping presents an environmentally sensitive approach that offers aesthetic advantages as well.

### GENERAL STANDARDS

#### Basewide

Prior to planning, the landscape architect shall perform a detailed site analysis and prepare a preliminary concept plan for the entire project.

The landscape contractor shall perform landscape establishment procedures for a period of at least 120 days from the completion of the entire project.

Landscape design shall comply with the Base Land Management Plan and Landscape Development Plan, May 1996 and AFCEE AF Landscape Design Guide. All landscaping shall be

integrated with the surrounding or existing landscape.

Landscape planning should be based on xeriscape practices (See Planting/Xeriscape Standards, next section).

Landscape plans shall incorporate species from the Davis - Monthan Landscape Development Plan Plant List. The Arizona State Department of Water Resources/Southern Arizona Water Resources Association approved low water plant list may be used as a secondary resource.

Use landscape material to minimize stormwater runoff.

Use landscape elements to reduce energy costs; shade to reduce heat and glare, wind breaks to lessen air infiltration. Use trees in conjunction with manmade structures to provide shade and shelter at playgrounds, picnic areas and community open

spaces.

Use berms to screen and restrict views. Limit berm slopes to 1 foot in 10 feet. Do not use earth berms against building walls.

Due to the harsh climatic conditions at Davis - Monthan, designs should plan for above average plant loss. Allow for loss of some plant material without disrupting the overall planting scheme.

Avoid planning equally spaced, repetitive rows of planting.

Due to high maintenance requirements, sheared hedges and annual/perennial flowerbeds should be used sparingly. Proposed use of flowerbeds must be approved by Base Architect

Basewide, landscaping should be used in conjunction with site walls, for visual screening of mechanical equipment, dumpsters, loading docks, etc. Locate



A

equipment, dumpsters, loading docks, etc. away from building fronts and other high visibility areas.

### *Buildings*

Provide a landscaped space uncluttered by vehicles in front, at the entrance and between the main viewing street and the building. Major high visibility buildings and activity areas should be punctuated by defined entry



*B*



*C*

plazas. Planting, special pavement treatments and site furnishings should be incorporated as appropriate to reinforce the prominence of the building.

Planting should be used adjacent to buildings to assist in defining primary spaces relating to the building (courtyards, ramadas, paths, seating plazas, break areas, etc.) and to address building scale. Planting should, in general, be more substantial against the building and diminish as distance from the building or ramada increases.

Landscape planning for mission specific facilities such as hangars and maintenance/storage buildings should be purely functionally driven. This could, in some cases, result in no landscaping on the flightline side of specific buildings.

Mission facilities and facilities fronting or having prominent facades on Arizola Street, First Street and Phoenix Avenue (Mission/Mission Support Zones border) should include appropriate landscaping on the street side.

- A. Berms and mounded landscape applications screen views and add relief to the flat landscape.*
- B. Landscape placement can help identify building entrance.*
- C. Landscaping used to punctuate an entry plaza. (Building 4859)*



## PLANTING/XERISCAPING

### CURRENT CONDITIONS

**D**avis - Monthan AFB has done well in its ability to address, with landscaping, the geographical, cultural, and climatic conditions of the region. Average summertime temperatures hover around 100 degrees; hence it is imperative to use plant species requiring little moisture (whether indigenous or exotic) combined with inert groundcover materials such as gravel mulches and boulders. This practice - known as xeriscaping - significantly reduces the long-term need for irrigation and maintenance.

While variation from this xeriscape approach may be justified in some instances, it is clearly the most logical and aesthetically pleasing direction in use at Davis - Monthan.

### GENERAL STANDARDS

**U**se xeriscape principles in all plant material selection and landscape design at Davis - Monthan AFB. Basic xeriscape principals include:

- Group and locate higher water use plants close to human use areas.
- Limit turf areas.
- Employ water efficient irrigation systems. See Irrigation and Water Usage section of this document for specific information.
- Passively harvest rainwater for beneficial use.
- Improve and protect soil with organic and inert mulches.

Gravels in multiple colors and sizes allow a variety of application options. Mulch use shall be limited due to its moisture content and the drying effects of the sun. All inert material shall be treated with an approved pre-emergent herbicide prior to the completion of the project

- Use low water plant material as per the Davis - Monthan Landscape Development Plan Plant List.
- Specify proper maintenance materials.

Conditions found at Davis - Monthan limit the use of lush plant material as a viable groundcover. Plant material, if used as a groundcover, should be selected based on limited water and maintenance requirements.



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23



B

DESIGN COMPATIBILITY STANDARDS





C



D

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

# • ACCEPTABLE INERT MATERIALS

- Decomposed Granite - red, 3/4" or less
- River Stone - salt river rock, 3"-8".
- Boulders - Catalina Mountain granite, 8-64 cubic feet,
- All inert materials shall be included as submittals on AF Form 66, Schedule of Materials Submittals.

• A. Xeriscaping does not necessarily mean lack of color.

• B. Saguaro cactus.

• C. River rock, decomposed granite and low water plant material. (Building 5426)

• D. Inert ground cover used to define a path.

## ***SITE FURNISHINGS***

### ***CURRENT CONDITIONS***

While site furnishings and related pedestrian amenities are present at Davis - Monthan, applications are largely facility specific rather than adhering to a basewide standard. A wide variety of styles of benches, shelters, trash receptacles, and other amenities are found.

### ***GENERAL STANDARDS***

Site furnishing should be considered in all new construction, renovation and street improvement projects. In addition to those listed above, site furnishings may also include play equipment, tables, mailboxes, drinking fountains, and flagpoles. Some base-standard furnishing are indicated on the following page. Standards for picnic shelters are discussed in the chapter Ramadas, Courtyards and Shelters.

When site furnishings are warranted, use the base standard furnishings to reinforce overall visual harmony. Submit amenities not included in base standards for review and inclusion into base standards. Amenities include trash receptacles, ash urns, benches, tables, mailboxes, drinking fountains, telephone booths, bus shelters, kiosks, flagpoles, bike racks, and picnic shelters.

Furniture shall be comfortable, durable, vandal resistant and easily maintained.

Site furnishing shall be accessible to the handicapped and comply with the requirements of ADA/UFAS.

Furniture colors and materials should complement the surrounding architecture.

Tables and benches should be made from wood or recycled materials. Color shall be grey or brown tones.

Trash can/ash receptacles and drinking fountains shall be precast exposed aggregate concrete. Trash cans shall have dark brown plastic lids. Concrete color shall have beige and brown tones.

Unless otherwise noted, metal shall be dark bronze.

Consider climate conditions in selection and placement of all site furnishings. Solar factors, such as direct heat gain on metal components (especially play equipment), ultraviolet degradation of plastics and shade for users should be addressed. Wind protection, especially during months characterized by strong prevailing winds should also be considered. When possible, take advantage of shelters, ramadas, landscaping and building mass for solar and wind protection.

Play equipment selection and placement should consider age groups ranging from pre-school to teen. Place play equipment away from vehicular traffic paths in locations easily supervised.

Create small pedestrian pockets along paths by grouping picnic tables, benches, trash receptacles and paving. Develop the surrounding landscape to define the space and provide shade.



*A*

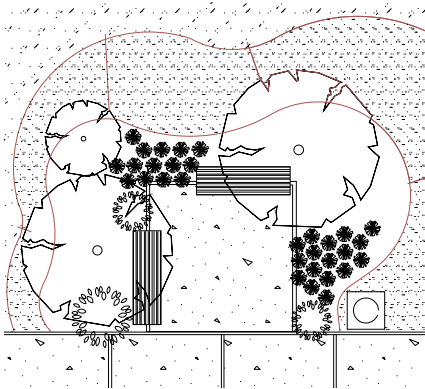


*B*



4301

4101



C



D

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA



## Acceptable Manufacturers

### Picnic Table

#### Manufacturer, Style

Columbia Cascade, Timberform,  
Boulevard Series  
Landscape Forms, Inc., GR4305-56-  
54

### Bench

#### Manufacturer, Style

Columbia Cascade, Timberform,  
Greenway Series  
Landscape Forms, Inc., "Gretchen's  
Bench" Series  
Ultrum, Contour SeriesUF1517

### Drinking Fountain

#### Manufacturer, Style

Environmental Features, Inc., Type  
182  
Cambridge Designs, Aggregate  
Collection

### Bike Rack

#### Manufacturer, Style

Brandir International, Ribbon Rack  
Madrax, Heavy Duty Winder  
Columbia Cascade, Original  
CycLoops

### Trash/Ash receptacles

#### Manufacturer, Style

Architectural Precast, Ash/Trash  
Combo Model 4301 or 4101  
Architectural Precast, Side Opening  
Round Receptacle UL-1233  
Du Mor, Inc., Receptacle 44

A. Benches in shaded areas provide shelter from the sun.

B. Typical playground equipment and shaded picnic area.

C. "Pedestrian pockets" provide areas for socializing.

D. Example of base-standard bus shelter. Provide landscaping and ash/trash receptacles adjacent to shelter areas.



## IRRIGATION & WATER USAGE

*Refer to Base Civil Engineering for current approved irrigation practices and products.*

### CURRENT CONDITIONS

Irrigation is widely used at Davis - Monthan to support both native and imported plant material. Most significant landscape installations on the base will be irrigated at least until well established. A large portion rely on permanent irrigation to survive - including most lawns, shrubs, smaller trees, and recreation area landscape installations. Both "bubbler" and "drip" systems are currently in use. Irrigation, while enabling new plants to establish and older plants to survive, is a burden on a limited natural resource. In addition overwatering can make plant establishment periods longer, increasing dependency on man-made water sources.

### GENERAL STANDARDS

Temporary irrigation should be used as a means to establish native or naturalized landscape installations. Permanent irrigation should be limited to major landscape applications at focus areas and special situations only. All irrigation installations must be approved by the Base Project Manager.

Due to mineral buildup and environmental factors (animals/uv) drip irrigation systems are limited in use and longevity. Bubbler type head are a good alternative. Use spray

heads for lawn areas only. Minimum 1/2" PVC piping should be used.

Reduce supplemental irrigation requirements by directing runoff from "clean" hardscape areas, roof drains and slightly bermed areas where possible, to landscape areas.

Minimize turf areas requiring supplemental irrigation to locations of high visibility and to active/passive recreation areas such as areas near a ramada or tot lot. Wherever possible, combine areas of turf with areas of inert ground cover, limiting use of turf to smaller "targeted turf areas" selected for high visibility.

All irrigation materials, workmanship, and irrigation controller elements shall be concealed as much as possible and guaranteed for a period of one year from the completion of the entire project.

*A. Inert groundcover minimizes irrigation requirements.*

*B. Spray type irrigation at recreation area.*



A



B

DESIGN COMPATIBILITY STANDARDS

## ACC ARCHITECTURAL DESIGN STANDARDS

### POLICY STATEMENT

**T**he special character of defense installations dictates compatibility over personal style. The limited size and function of Air Combat Command (ACC) bases cannot accept the diverse opinions of the many design professionals without becoming cluttered and unsettled. In this context 'good design' is defined as design that contributes to the overall harmony of the base rather than design that attracts individual attention. Good examples of where ACC design goals should lead are college campuses and corporate office parks. Because we do not want monotony, every building does not need to be the same, but some common architectural element or theme should tie all buildings together. Responsible design will achieve this goal.

Use a simple approach to locate facilities. Facilities having similar functions should be located in the same vicinity on uncongested sites, but do not permit parking to dominate. Use indigenous, low maintenance landscape material. Relate building forms to each other

and use low maintenance materials. Do not paint new buildings. Use materials that do not require painting during their lifecycle. Use neutral colors such as grey and brown."

### GOALS

**T**he following goals have guided the above ACC policy and should also guide all levels of design at Davis - Monthan:

- **Site Conditions** - Provide site conditions and building forms appropriate to any new, future or existing buildings.
- **Low Maintenance** - Use permanent low maintenance exteriors that are compatible with ACC bases and their natural and man-made environments.
- **Environmental** - Design facilities in ways to enhance environmental quality and minimize consumption of natural resources.
- **Layouts** - Provide functional layouts that completely satisfy user needs.
- **Cost** - Reduce lifecycle costs.

- **Labor** - Reduce labor intensive maintenance procedures.
- **Approval** - Obtain user approval of design concept layout prior to predesign conferences in order to prevent costly changes during final design, contracting and construction. This is normally done through Customer Concept Document prior to preparation of programming documents.

- **Accessibility** - The site and interiors of all facilities shall be designed for accessibility in accordance with the ADA accessibility guidelines whenever they allow for equal or greater access than is provided under the Uniform Federal Accessibility Standards. An exemption may be given for facilities specifically designed for military personnel occupancy and use.

While the guidelines presented in the following pages are specific to Davis - Monthan Air Force Base, the overall design philosophy of the ACC, stated above, is the foundation upon which these specific recommendations are based.

## ARCHITECTURAL STANDARDS



## HEIGHT/MASSING

### CURRENT

**B**uilding function, evolving construction technology and changing aesthetic tastes, over time, have resulted in a wide variation in building forms and sizes at Davis - Monthan.

*Zone 1* is easily characterized by the hangar and maintenance buildings in the flightline area. Required to provide large open work bays and to accommodate equipment, the buildings are large with simple, utilitarian massing. In addition to the mission based facilities, *Zone 1* does contain a wide variety of smaller scale structures of various function and character.

Miscellaneous administrative support, storage and maintenance structures related directly to the hangars are scattered throughout the zone.

In addition to size, *Zone 1* structures differ in site orientation from buildings in other zones. *Zone 1* buildings are oriented to the runway and flightline, not to base streets. This often means that the back of a *Zone 1* building will front a main public street. *Zone 1* shows the fewest consistencies in height, scale and massing due to the function-driven design of its structures.

*Zone 2* structures are generally one and two story in height, dormitory buildings at three stories being the obvious exception. Generally compact and rectangular in plan these structures reflect a practical design response to their administrative, community support and dormitory uses. Some consistency in setback, relationship to the street and entry definition are apparent on many of the buildings in *Zone 2*.

*Zone 3*, family housing, consists entirely of one and two story

structures, residential in both character and scale. Consistent street setbacks within individual housing developments combine with the consistent massing and materials to create the most architecturally cohesive zone on the base.

*Zone 4*, AMARC, shares much in common with *Zone 1*. AMARC structures are generally utilitarian. Buildings of various ages, sizes and function create a relatively chaotic first impression.

### GENERAL STANDARDS

**H**eight - Building heights at Davis - Monthan should be reviewed on a case by case basis. Specific program needs may define or restrict the number of stories or height. In general, except for dormitories, building heights at Davis - Monthan should be limited to two stories above grade. Basements should not be used.

Building massing should generally be simple and economical; rectangular plans with sloped roofs. Avoid uneconomical shapes such as curves,

diagonals and long rectangles unless specifically justified by site or building function. Use 90-degree corners unless there is a functional justification or aesthetic response to an existing condition.

Primary building form should emphasize horizontal rather than vertical elements.

Building entrance should be defined in a fashion appropriate to the buildings function.

Due to the utilitarian nature of buildings within *Zones 1* and *4* compatibility in building height and scale is often problematic. Structures of conflicting scale should be connected by design elements such as similar masonry base treatment, banding, coloration, etc. Building 5426 represents a successful example of a masonry base that unifies conflicting scaled masses.



B



A





C



D

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

A. A masonry base can visually connect building wings of different height or scale. (Building 5426)

B. Inappropriate building form.

C. A distinct horizontal massing emphasis and defined entrance. (Building 4859)

D. Simple massing, compact plan and sloped roofs are typical of Zone 2. (Building 2614)

## ROOFS

### CURRENT

Roof forms and materials surveyed at Davis - Monthan vary considerably. As with the architecture of the entire base the roofs types directly reflect the changing technology over time and the varied building functions across the base. Flat roofs, both built-up and newer membrane roofs occur basewide. Curved and low slope metal roofs of various ages and types can be seen on hangar and service buildings. Higher sloped standing seam metal roofs occur basewide on medium and small scale structures. Housing in Zone 3 is typically fiberglass shingles and concrete tile roofing.

Roof coloration is generally limited to brown tones, from dark and medium browns to light tans and white. The most visible exception is the 12<sup>th</sup> Air Force Headquarters (Bldg. 12) with its bright copper standing seam metal roof.

The most positive and unifying trend on the base is the turn toward the use of medium slope standing seam metal roofing in zone 1, 2 and 3, and the consistent use of fiberglass shingles in the new housing areas. While flat roofs are well represented in both new and older structures, the turn toward sloped metal roofs has provided the beginning of a more positive overall base character.

### GENERAL STANDARDS

New roofs in all zones at Davis - Monthan should be of gable or hipped design with a slope of 3:12. Design roofs to slope to the building's perimeter to assure proper drainage. Do not create interior valleys or depressions that have the potential to pond water.

Standing seam factory finished metal should be used in zones 1, 2 and 4 and heavyweight reinforced fiberglass

asphalt shingles or concrete tiles on housing in Zone 3. Medium scale structures such as day care and schools that may occur in zone 3 should incorporate standing seam metal.

Sloped metal roofs shall be light to medium browntones, greytones and parchment. Dark colors should be avoided in the harsh desert climate.

Building scale and economy may dictate the use of long span metal roofs or "flat" roofs. If used, long span metal roofs should have a minimum slope of 1-1/2:12. "Flat" roofs, if used, should be multi-ply, built-up with a minimum slope of 1/4 inch per foot. Roof slope should be accomplished with structural members, not tapered insulation.

Designers are encouraged to use strategically placed sloped roof elements to punctuate key building points (entrances for example) and to screen portions of the flat roof where possible. Although a small scale building, the veterinary clinic (Bldg. 2712) uses a sloped metal roof to punctuate entry on a flat roof structure. All low slope or flat roof must be approved by the project manager and ACC Command Architect.

Skylights and clerestories may be used if strong economic and functional criteria dictates. If such

elements are proposed full economic justification including life cycle cost shall be submitted to the project manager.

Roof overhangs and trellis elements should be considered for sun control. Solar gain can be reduced substantially, especially at window locations, by simple shading.

Fascia design becomes especially critical when broad overhangs are used. If pronounced fascias are used on metal roofs the fascia material should exactly match that of the roof. Seam treatment may vary however color and material should match. A metal fascia should never extend above the edge of the sloped roof. In no case should a metal fascia be used on a flat roofed building. Stepped gable ends such as occur on Building 1630 are an acceptable gable end treatment.



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DESIGN COMPATIBILITY STANDARDS

Gutters are recommended, but not mandatory, on all sloped roof buildings. Downspout placement should be carefully considered and well integrated into the overall design. In high profile buildings, conceal the downspouts in columns or pilasters. Interior downspouts, however, should not be used.

All fascia, gutter, and roof trim material shall be made of prefinished metal and be designed to prevent oilcanning deformation due to expansion and contraction.

Vents, piping and equipment forced to penetrate the roofing should be treated as a trim material and painted to match the roof. Locate these elements on the rear slope of roofs, out of view if possible. Combine penetrations when possible or create a pattern to reduce visual clutter.

Equipment should, in no case, be located on sloped roofs. If rooftop equipment is used on flat roofs, it should be located to the rear or areas out of view. In such cases, the User may be required to fund maintenance on the equipment unit and roof.



C



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F

- A. Trellis element can help identify and shade a building entrance.
- B. Dormitory with typical sloped, standing seam metal roof, and broad, shading overhang.
- C. Inappropriate slope on metal roofed building. (Building 5303)
- D. "Stepped" gable end. (Building 1630)
- E. Tile roofs in family housing.
- F. Strategically placed sloped metal roof helps to identify entry. (Building 2712)



## EXTERIOR WALLS

### CURRENT

As with roofs, exterior wall materials and finishes vary widely at Davis-Monthan. Within zones 1, 2 and 4 a full range of masonry treatments are present including ribbed and split face concrete-masonry units (CMU), painted CMU, brick, aggregate panels and limited applications of pre-cast concrete. Within the same zones many buildings are finished in various metal wall systems. Zone 3 with its widespread use of stucco represents the most consistent zone of the base in terms of exterior wall finishes. The color palette in zones 1, 2 and 4 ranges from white and light tan through medium and dark browns. Stucco in zone 3 ranges from light tans and beiges through pink.

The most positive trend (aside from the consistent use of stucco in zone 3) is the recent use of split face and ribbed CMU combinations. Used in various mixes, the material allows pattern, texture and color flexibility and variety within a single durable material. Buildings 2300 and 5426 represent excellent applications of a mixed CMU palette. Hangar building 1750 on the other hand represents a fairly successful union of two exterior wall finish types. The large span metal center section of the building is wrapped by a smaller scale split face

and ribbed CMU addition. The addition of the CMU at the perimeter reduces the scale of the hangar and brings the entire structure more in character with adjacent smaller scale masonry structures.

### GENERAL STANDARDS

In zones 1, 2 and 4 integrally colored split-face and ribbed CMU should continue to be used as the primary exterior wall finish. All CMU should be manufactured with additives to discourage efflorescence.

Usually a single color CMU with one metal color produce the best results. Wall color variations within a single building should be limited to a split-face primary block with one type and color of accent, either CMU from the approved list or precast or exposed aggregate.

Articulation of the walls should occur through changes in the wall plane and variations in texture and color within the masonry palette, not through the use of paint or material changes. In addition to adding visual interest to the wall, in appropriate applications masonry articulation can aid in identifying building entry.

If, in large scale structures such as hangars or warehouses, function and budget dictate the use of pre-

engineered metal building system a masonry “base” should be used. The base serves both to protect the portions of the building subject to impact damage and to better blend the structure with the basewide CMU aesthetic. The base should match the masonry color, texture and height of any adjacent administrative or support buildings. Building 5426 (photos on pages 32 and 43) represents a good example of a masonry base on a metal sided structure.

Metal wall panels when used should be factory prefinished aluminum or galvanized steel with a 20 year guarantee against fading. Use of metal siding requires approval of the Base Architect and ACC Command Architect.

When upgrading existing CMU and frame structures, stucco, exterior insulation and finish system (EIFS),



precast concrete and limited exposed aggregate panels are acceptable. These materials are limited primarily to renovation applications and require approval from the Base Architect and ACC Command Architect.

New construction in Zone 3 should use stucco as the primary exterior wall finish. EIFS may be used for renovation in Zone 3 but requires review and approval by the Base Architect and ACC Command Architect.

Main entry doors in all zones should be glazed storefront in approved colors. Exterior doors and frames on houses in Zone 3, personnel doors in all zones, and overhead doors in all zones shall be painted or prefinished, insulated metal. Color shall match the adjacent walls or be of a complementary contrasting color.

Extraneous wall attachments such as downspouts, conduit, switches, bells, hollow metal frames, etc. should not be emphasized by painting. Such elements should be strategically placed across the building and factory finished when possible or painted in a color to match adjacent prefinished exterior metals or adjacent wall color. Use one trim color to the greatest extent possible. Provide flat CMU to attach wall-mounted switches, light fixtures, through-wall vents, etc.

New buildings should not require exterior painting. Standard CMU, metal wall panels, stucco, EIFS, etc. that are normally restored by painting should not be used in Zones 1,2 and 4.



C



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E

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

- A. Synthetic stucco walls typical of new housing in Zone 3.
- B. Split face CMU walls with precast concrete fascia and columns in Zone 2. (Building 2300)
- C. Inappropriate application of metal siding! (Building 5303)
- D. Typical example of ground face and ribbed CMU combination. (Building #2614)
- E. A combination of textures and colors of CMU exterior veneer adds interest to exterior walls..

## WINDOWS

### CURRENT

As with roof and exterior wall materials window types at Davis - Monthan vary from building to building, based on age and function. Large steel framed industrial sash windows can be found on several of the hangars and maintenance buildings. Immediately adjacent may be support or administrative structures with insulated, fixed windows in deep-set punched masonry openings. Operable windows of various types can be found in the Zone 3 housing.

Most recently constructed buildings have used double glazed insulated units, generally set in thermally broken anodized bronze or dark brown metal frames. Due to the desert sun many buildings have the windows recessed into deep masonry openings. This window type complements the shift toward the split-face CMU wall and standing seam roof palette encouraged on the base. In zone 3, the use of operable bronze and dark brown windows, zone-wide, creates a desired consistency that should be continued.

### GENERAL STANDARDS

New windows at Davis - Monthan should have bronze tinted, double glazing set in thermally broken anodized aluminum frames. Triple glazing, for sound control, should be used in windows along the

flightline and in Air Installation Compatible Use Zones (AICUZ). Toilet windows should be frosted glass.

Limited glazing in punched masonry openings should be used in Zones 1,2 and 4. The base is flexible, with regard to the amount of glazing used on a building. If appropriate, limited window groupings, glazed entry doors with sidelights and other variations are acceptable. Large curtainwall applications are not acceptable in Davis - Monthan's desert climate.

Operable windows are prohibited in air conditioned structures in zones 1,2 and 4. Operable windows are mandatory in all temporary and permanent quarters in all zones.

When possible, recess windows for solar control. Solar control is mandatory at *all* south and west facing windows. Solar shading film shall not be used for sun control at new installations. If window blinds are used they should not be of reflective metal.

Skylights and clerestories may be used if strong economic and functional criteria dictates. If such elements are proposed, full economic justification including life cycle cost shall be submitted to the project manager. Clerestory windows should be designed to minimize solar heat gain

through orientation or shading.

Replacement windows should be evaluated on a case by case basis. Unless otherwise justified, replacement windows should adhere to the guidelines for new windows. Any variation shall require review and approval by the project manager.



B



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C



D



E

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

- A. Balconies and deep overhangs shade windows of dormitories. (Building 3508)
- B. Recessing windows into masonry openings reduces solar gain.
- C. Shaded entry glazing. (Building 2300)
- D. Unacceptable! Flush, unshaded windows on a south facing wall. (Building 5426)
- E. Unacceptable! Large curtainwall applications exposed to afternoon sun. (Building 12)

## ***SITE WALLS AND FENCES***

### ***CURRENT***

Serving as property and security boundaries, visual screens and wind breaks, site wall and fences are a prominent feature of the Davis - Monthan landscape. Occurring in all zones the primary materials are split face and ribbed CMU, chain link and limited applications of wood.

The use of split face and ribbed CMU for the majority of the solid screen walls and fences is clearly the most positive trend visually. As with exterior walls the use of this type of CMU allows design flexibility within the context of a single inexpensive, durable material. The color and texture of the block and the horizontal emphasis of the walls blend well with the character of the desert and reflect the material palette of much of the architecture. This adds to the visual harmony of the base sought in the overall ACC design policy. Fences and site walls should continue to be encouraged as boundary elements, visual screens and wind breaks at Davis - Monthan.

### ***GENERAL STANDARDS***

Site walls should be of split-face block, in a maximum of two colors with a solid top course. When used in conjunction with a new building the material and design should match the block on the new building.

Any decoration on site walls and fences should be achieved through variations in the wall plane and the use of perforated block or open voids in the block coursing at selected locations. Variation in height and surface plane may be considered where appropriate for stability and aesthetics. The horizontal character should however remain the prominent image.

Avoid the use of chain link fencing.

In zone 3, fences at main boundary areas (street edges, project boundaries, etc.) should follow the above guidelines. Fences separating individual yards should be masonry.

Provide base standard three-sided CMU enclosures for all dumpsters (detail available through Project Manager or Base Civil Engineering). Enclosures should follow the guidelines for masonry site walls. When used in conjunction with a new building the material should match the block on the building.

Dumpster enclosures should be located in parking lots to the side or rear of facilities and in such a manner as to minimize traffic conflicts. Orient the open end, when possible, away from building entrances and primary views and include a concrete apron and steel gate. In Zone 3 dumpsters should be located away from front yard areas.

Dumpster enclosures, fences and site walls in general should be located a minimum of 20' from any road to ensure that the visual line of sight for motorists is not obstructed.



*A*



*B*



C



D



E



F

- A. Masonry site wall along Yuma Street flightline boundary.
- B. Unacceptable! Chain link fencing along Arizola Street provides no visual screening of flightline activity. Use masonry!
- C. Masonry screen walls with metal rail infill in housing zone, provide privacy without blocking views toward golf course.
- D. Typical CMU dumpster enclosure.
- E. Masonry screen wall blocks view of flight line activities.
- F. Stepped site walls screen views of parking and edge entry plaza. (Building 12)



## ***ADDITIONS, METAL BUILDINGS AND TEMPORARY STRUCTURES***

### ***CURRENT***

**T**emporary structures, additions and especially metal buildings dot the built landscape at Davis - Monthan. Construction of these types of structures is the result of the functional, economic and time factors that arise from mission demands. Mixed results can be observed throughout the base. The use of temporary structures for long periods and small metal buildings is not encouraged.

Building 5129, totally unshielded and unsympathetic to surrounding buildings, represents an inappropriate use of a metal building. At nearby Building 5426 integration of a masonry base with the metal building construction creates a structure much more in the character of the zone. Building 1750 represents a successful addition strategy. Sloped roof, split face CMU additions enclose the existing large scale hangar structure, bringing it closer to the architectural character desired at Davis - Monthan.

### ***GENERAL STANDARDS***

#### ***ADDITIONS***

**M**aterials and massing should follow the general compatibility standards as outlined within this document.

When designing additions, consider two strategies: simply matching the existing building; and designing the addition to conform to base design standards while updating the existing structure.

In general, small additions (less than 25% of the existing floor area) should match the existing construction.

In large additions (exceeding 25% of the existing floor area) both the

addition and the original structure should be brought into compliance with these Design Compatibility Standards.

For example, a flat roofed building of 10,000 square feet requires an addition of 3,000 square feet. The addition exceeds 25% of the existing floor area of the existing building. The addition should have a sloped roof and if possible the original building should be retrofitted with a sloped roof. If the original building were plain CMU, a new exterior wall finish of split face CMU should be used, either as a complete veneer or at strategic visual points (entries, planters, sign, corner protection, etc.) .

Regardless of size, completed additions should be architecturally compatible rather than obvious additions.

### ***METAL BUILDINGS***

**U**se metal buildings where compatible with adjacent structures. Do not use metal buildings in highly visible locations unless surrounded by other metal buildings.

All metal buildings require ACC approval regardless of location.

Use factory applied metal finishes with 15 year (or longer) warranties.

At the programming phase, submit siting criteria. Indicate adjacent building construction. If the building is isolated, describe visibility from major, minor and service roads. State the reasons for selection of metal over masonry in addition to cost considerations.

Provide masonry on the exterior of metal buildings where impact



**A**



**B**

damage is probable. Integrally colored masonry should be used at entrances and corners. Use exterior wainscot to four feet where metal buildings are placed next to other buildings, around forklift operations, and at loading docks.

### TEMPORARY BUILDINGS

**I**n high visibility areas, special consideration must be given to the design of temporary buildings in order to comply with the Design Compatibility Standards. Temporary buildings or structures may be reviewing stands or other miscellaneous structures, sheds, canopies or fences used for protection of the public around and in conjunction with construction work. Temporary structures shall be completely removed upon expiration of the approved time limit. All base architectural and engineering design standards such as traffic and parking

requirements, accessibility standards, and fire requirements shall apply to temporary buildings except as noted below.

Exceptions to these standards include:

- As defined by the Uniform Building Code, any type of construction may be used for temporary structures.
- Exterior walls may be finished with wood or metal siding as long as the architectural character, form and colors are compatible with surrounding facilities.

Submit proposed time limit, floor plans, exterior elevations, exterior color samples, and site plan to Base Architect for approval. On the site plan show building location, parking, handicapped accessibility, and utility service locations and connections.



C



D

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

- A. Masonry wings lessen the impact of a metal hangar structure. (Building 1750)
- B. Typical metal buildings along the flightline.
- C. Unacceptable! Incompatible with adjacent masonry and masonry/metal buildings. (Building 5129)
- D. Acceptable. Masonry base softens impact of metal building construction. (Building 5426)

## ***RAMADAS, COURTYARDS & SHELTERS***

### ***CURRENT CONDITIONS***

Outdoor courtyards, ramadas and shelter areas can be found at various locations on the base. A prominent new ramada is part of the overall site layout of the 12<sup>th</sup> Air Force Headquarters Building. This new ramada has ample outdoor cooking facilities, seating, and expansive grass lawn.

A need exists at Davis-Monthan for additional protective exterior courtyards and ramadas for staff break areas, picnic shelters, and playground observation.

### ***GENERAL STANDARDS***

Protected outdoor employee breaks areas, picnic shelters, playground and park shelters should be included, when justified by occupancy, in new construction, site improvement and renovation projects. Ramadas should be included in all new playground and park designs.

Outdoor shelters and courtyards should generally conform to the architectural guidelines of the Zone in which they occur. If serving a specific building, materials used should match the building being

served.

Orient shelters and courtyards to take advantage of climate conditions, such as seasonal sun, shade, and breezes.

Provide site furnishings, lighting and landscaping as necessary to both support the function and create an inviting gathering zone. Landscaping should consist of soft textured, finer material deemed relaxing and inviting to touch and smell. Avoid rigid, sharp, and prickly plant materials. If appropriately small, natural grass lawns can be used to encourage family interaction. Synthetic turf lawns are also an option in increasing the overall usable “green” space.

Consider incorporating sand volleyball courts or very large boulders for seating, climbing and aesthetics, and to serve as gathering areas or focal points.



*A*



*B*





C



D



E

- A. Picnic shelter at an outdoor play area.
- B. Excellent example of Ramada construction; twin ramadas serving 12th Air Force Headquarters. (Building 12)
- C. Attached ramada. (Building 1750)
- D. Unacceptable! Ramadas should match adjacent building vocabulary.
- E. Acceptable. Ramada matches dormitory beyond.

## EXTERIOR SIGNS

### CURRENT CONDITIONS

Most signs at Davis - Monahan AFB are in conformance with, or close to being in conformance with, ACC Standards. Most exterior signage is fairly subtle and harmonious with the architecture. Where special signs (free-standing, marquee signs) are used, they are generally appropriate in size, location and design. As with much of the architectural design at Davis - Monahan, the most recent development presents the most positive and consistent sign trends.

### GENERAL STANDARDS

#### SIGNS (GENERAL)

The number of signs should be held to the minimum required for identification and customer service. Lettering attached to buildings, structures, monuments or

entryway glass shall be white, beige or bronze. For other types of exterior signs, white lettering on a brown background with brown posts is the standard, with the exception of signs relating to safety and governed by National Standards applicable to the USAF. Such exceptions include traffic control signs governed by the Manual of Uniform Traffic Control Devices (MUTCD) and signs governed by OSHA. Examples include regulatory and traffic control signs (speed limit signs, stop signs, yield signs) and hazard/danger signs. Such special signs mandated by National Standards must be of the required colors and design. All signs on base will adhere to standards set forth in AFP 88-40 (except that color shall be white letters on brown backgrounds and posts shall be brown), ACCR 88-1, ACCI-32-1054 and MUTCD.

### BUILDING IDENTIFICATION

All buildings at Davis - Monahan shall have a street address affixed near the main entrance. The street address is sufficient to identify the majority of the facilities on base.

#### Zones 1, 2 and 4

Street address applications shall be individual bronze dimensional letters mounted directly to building fascia or exterior wall adjacent to the facility's main entrance.

If a building name sign is necessary, it will require Base Architect approval. Building name signs shall be individual bronze dimensional letters, all capitals, mounted directly to the building fascia or exterior wall adjacent to the facility's main entrance or a monument-type sign as directed by Base Civil Engineering.



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43



C

DESIGN COMPATIBILITY STANDARD.

No signs within the AMARC aircraft tow-zone shall exceed 36" in height.

### *Zone 3*

Addresses on residential units shall be white pressure sensitive letters on a dark bronze metal panel mounted adjacent to the unit's front door, visible from the street.

### *AAFES/DECA/COMMERCIAL SIGNS*

Any signage incorporating commercial logos or colors will require Base Architect's approval. Bases for such signs shall match the primary CMU used on the building they serve. The Burger King sign on Craycroft, pictured below represents an acceptable commercial sign treatment

Logo and lettering supplied by AAFES/DECA or the parent organization are required to be light bronze or dark bronze.



*D*

The format shall be the AAFES logo followed by the facility name, i.e., AAFES BASE EXCHANGE. This format shall be used for all AAFES facilities, including shopettes, laundry and dry cleaners, military clothing sales, class six stores.

Logo and facility name shall be the same height and positioned on one continuous horizontal line.

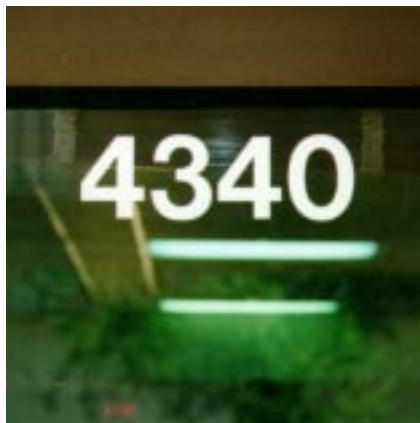
Facility name shall be spelled out completely with individual letters.

Logo and letters shall be mounted directly to the building fascia or exterior wall adjacent to the facility's main entrance, visible from the street.

Logo and letters shall be light or dark bronze anodized aluminum or plastic in a light or dark bronze color. Select finish color for maximum contrast and readability.



*E*



*F*

- A. Dimensional building name signage. (Building 2525)*
- B. Dimensional building number signage. (Building 4224)*
- C. Unacceptable! Painted "supergraphic" building number*
- D. Unacceptable! Painted building name.*
- E. CMU base matches the building served by this commercial sign.*
- F. Pressure sensitive vinyl building address on glass entry door:*



Logo and letters shall be available in even height increments from 2 inches to 16 inches. Choose the appropriate size for each facility and location.

The ratio of height-to-depth of logo and letters shall be approximately 8:1.

#### MONUMENT SIGNS

**M**onument-type signs at Davis - Monthan shall be constructed of approved split-face or ribbed CMU with a metal sign insert. The monument size standard is available from Base Civil Engineering. Do not use post-mounted signs. Monument-type signs must be approved by the Base Architect.

#### OTHER SIGNS

**M**arquee signs are defined as those constructed of masonry, illuminated or non-illuminated, with removable/replaceable lettering for updates. Authorized marquee locations are available from Base Civil Engineering. Any requests for new marquees must receive Base Architect approval.

Revolving or moving signs shall not be used.

Internally lighted signs shall not be used. When night visibility is required, use external flood or spot lights that illuminate both the adjacent landscape or building.

#### LETTERING SIZE

**F**or signs other than those covered by Air Force sign standards publications, size lettering according to the functional viewing distance. Keep sign size to a minimum. The rule to follow for readability is one inch of letter height for each 25 feet of view distance. Example: If a sign is intended to be read from a passing car using a road 100 feet away, the largest sign lettering would be four inches (100 divided by 25 equals 4). Do not oversize. Lettering on all Base signs shall be of the same style. Upper case Helvetica medium type style is recommended. Building numbers at Davis - Monthan AFB are typically 12 inches; building names are 18 inches.

#### APPROVED PRODUCTS/ TREATMENTS

**E**xterior Wall-Mounted Dimensional Letters - Individual characters shall be cast aluminum with bronze duranodic finish to match base standard. Characters shall be flush-mounted against the wall surface using masonry anchors or threaded screws.

Pressure Sensitive Lettering - Vinyl sheeting for die-cut graphics shall have a .003 to .006 film thickness and conform to Military Specification M 43719A. Color shall be white. The sheeting shall have a pre-coated pressure sensitive adhesive backing (Class 1) or positionable pressure sensitive backing (Class 3).



A

## INTERIOR SIGNS

### GENERAL STANDARDS

The graphics and interior signage shall be provided as a total system and shall be furnished and installed in accordance with AFP 88-40.

Signs shall be clear matte acrylic plastic with subsurface printed background color. Office identification signs shall have a clear sleeve to accept paper or plastic insert identifying tenant or tenants. With more than one door to a space, door numbers shall be alphanumeric, i.e., 110A, 110B, 110C. Restroom door signs shall be MEN and WOMEN graphic symbols, centered and mounted on the door with the top edge at five feet six inches above finished floor.

Height and location of signs shall be in accordance with AFP 88-40 unless otherwise specified. Signs shall be mounted using either vinyl tape or adhesive as recommended by the manufacturer for the specific application. Adhesive shall cover the entire back surface of the sign panel. Signs shall be mounted in place after all other interior work in the immediate vicinity has been completed.

### APPROVED SIGN TYPES

Refer to Department of the Air Force Sign Standards, Document AFP-88-40 and ACCI-32-1054, for full descriptions and specifications of interior sign types.



B



C

A. Monument sign with CMU base and sides.

B. Interior office identification sign.

C. Pressure sensitive building number on metal panel.





## ACC INTERIOR DESIGN STANDARDS SYNOPSIS

*ACC interior design standards are developed around an understanding of the elements and principles of design and on how the industry works, not around personal likes and dislikes.*

*To provide long lasting, appropriate interior color schemes and to avoid “trendy” colors in permanent finishes ACC interior design policy is based on an understanding and differentiation between permanent and non-permanent finishes.*

### PERMANENT FINISHES

*Permanent finishes are generally the hard surface structural interior design (SID) finishes that will last 15 to 20 years and whose removal and reinstallation is a major disruption to the facility. Such items as vinyl composition tile (VCT), ceramic and*

*other hard surface tiles, plastic laminates, toilet partitions, lockers, window blinds, all modular or systems furniture panels, work surfaces, flipper doors, etc. are considered permanent finishes. Generally permanent finishes need to be a color that will not become dated in a few years. Command standards require that all permanent finishes be brown or grey toned neutrals. These neutral shades can vary from very light (such as an off-white relating to a particular color tone) to a mid-range neutral of the same shade.*

### NON-PERMANENT FINISHES

*Carpet, paint, vinyl wallcovering, upholstery, artwork, etc. are considered non-permanent finishes. Non-permanent finishes will last from five to seven years under most conditions. Command standards allow non-permanent finishes to be of*

*any coloration appropriate to the facility. Most often these finishes will be in mid-range colorations. Very seldom would there be a use for pastel or very bright colors in facilities. Primary colors may however be used in youth centers, child care centers and bowling centers.*

*While non-permanent finishes are allowed in various colors, in office and other work areas it is highly recommended that the vinyl wallcovering or other painted wall surfaces be kept in neutral coloration. In other words, develop a neutral shell for the interior space with only the carpet, upholstery and artwork providing the color accent.*

*The interior finishes selected and installed should minimize or prevent volatile organic compounds (VOCs) emissions.*

## INTERIOR DESIGN STANDARDS

## FINISHES AND INTERIOR TREATMENTS

### GENERAL STANDARDS

#### PLANNING

Use permanent walls to divide open space offices into areas no larger than 3,000 square feet.

Adjust plan relationships to avoid large square plans which generally require flat roof construction. When possible, provide linear solutions of functional relationships to allow the use of 3:12 roof slope.

#### MATERIALS

##### *Walls*

Walls may be composed of gypsum wallboard on steel studs or block walls, plaster on block walls or other similar systems. These walls shall be finished with paint, wall covering, tile or other similar systems.

Painted or burnished block walls and similar systems are permitted at the following locations:

- Maintenance bays
- Equipment areas
- Storage rooms
- Utility rooms
- Electrical and mechanical rooms
- Secondary egress stairwells

Existing CMU walls shall be covered

with appropriate materials or hidden by new furring in renovation applications.

##### *Wall Protection*

Wainscoting is not recommended in most areas. A Type II heavy duty wall covering or chair rail should be considered in lieu of wainscot application. If wainscoting is required to avoid specific wall damage, the wainscot shall be between 36 and 42 inches high. The top edge of the wainscot shall be cap trimmed. Coordinate chair rail mounting height with the specific height of the chairs to be used if possible. In no case should chair rails be mounted above 42 inches. The chair railing finish shall match adjacent wall surfaces or other adjacent woodwork or doors. Heavy vinyl bumper guards may be used in corridors subject to unusual abuse. Bumpers shall be coordinating neutral colors.

##### *Ceilings*

Ceilings shall be 2-foot by 2-foot suspended acoustic tile ceiling, textured with tegular edges, or painted gypsum wallboard. Color shall be off-white to coordinate with the color tone of the walls.

Exposed ceilings are allowed:

1. When used as a deliberate design element.

2. In maintenance bay areas.
3. In utility/mechanical rooms.
4. Warehouses.

##### *Coatings*

Avoid materials that will require regular application coatings such as wax, paint or varnish.

### GENERAL FINISHES

Vinyl wallcovering shall be Type II in most applications. Type I has a limited use in most ACC facilities. Vertical texturing will help hide seaming.

Use a low sheen enamel for all painted surfaces.

Laminate surfaces shall have a speckled, flecked, mottled or granite pattern where possible. Soil and water spotting is not as apparent on such surfaces.

Ceramic floor tile shall have a speckled, flecked or mottled pattern where possible. Use dark colored grout coordinated with the tile to minimize a stained or soiled appearance.

Tile banding accents or patterns are acceptable for walls and floors



A

DESIGN COMPATIBILITY STANDARDS

provided the accent is another neutral shade which coordinates with the dominant tile color.

## FLOOR FINISHES

### Carpet

Refer to Air Force Engineering Technical Letter (ETL) 94-3: Air Force Carpet Standard and revised ACC Carpet Guidance - dated 12 October 1993. All projects requiring carpeting shall have submitted for approval an installation plan showing carpet seam locations, on AF Form 66, and carpet samples.

All carpet fiber shall be 100% nylon or nylon blend, and shall meet at least one of the following requirements:

1. Radiant panel test - Minimum average radiant flux of 0.25 watts or higher (0.50 watts or higher for carpet used in billeting, dormitories or hospital corridors.
2. Methenamine test - Passed

Carpet shall be patterned in all facilities with the following exceptions: bold tweeds or patterns are allowed in religious facilities and enclosed areas of 500 square feet or less; solid carpeting is permitted in all General Officer and Wing Commander office suites; and solid color carpet is permitted in Distinguished Visitor suites.

Carpet for fitness centers, athletic use, medical and health care facilities shall be anti-microbial, solution dyed. Dormitory carpet shall incorporate one carpet pattern per building with a different color-way per floor. Carpet in living areas should not match that used in work areas of the base. Do not use dull, drab colors in living spaces.

Carpet borders may be solid in color and may be used with carpet tile or roll goods. Install field carpet in rectangular shapes and allow border tiles to fill indentations such as doorways, drinking fountains, etc. Do not use borders in rooms where furniture will cover the border.

Carpet padding shall be used in residential facilities and sleeping quarters only. Padding shall be of a quality equal to synthetic hair and jute (no re-bond padding foam). All other carpet applications shall be direct glue-down application.

### Miscellaneous Floor Finishes

The following are acceptable floor finishes to be used as function and budget allow:

- Ceramic/quarry tile
- Aggregate flooring systems
- Masonry flooring
- Commercial grade sheet goods
- Low profile rubber flooring



B

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

A. Ceramic tile and plastic laminates come in a wide variety of speckled and mottled patterns.

B. Typical office interior in subdued neutral tones



- Athletic flooring
- Carpet/carpet tile

Vinyl Composition Tile use is limited to:

- Maintenance bays and areas
- Utility rooms
- Large equipment storage rooms
- High abuse corridors in maintenance facilities
- Areas with cost limitations

Natural finish/painted concrete floors are limited to:

- Maintenance bays
- Utility rooms
- Mechanical and electrical rooms

Light reflective, non-metallic surface floor hardeners are limited to:

- Aircraft hangar bays
- Maintenance bays

#### *Vinyl/Rubber Base and Carpet Base*

Use vinyl/rubber base in areas where the floor surface is vinyl composition tile (VCT) or rubber tile. Base is to be in a coordinating neutral to the floor surface, as near the same shade as possible. Do not use a dark color or accent band for the base. Use a four inch carpet base capped with a dark neutral vinyl/rubber carpet cap in carpeted areas. Use the same carpet for the base as meets the wall in the case of borders. When carpet tile is used, use a vinyl/rubber base. Choose a neutral that will most closely relate to the carpet color or wall color. With

carpet tile, a straight base must be used (one without a cove foot) and installed first with the carpet butted up to it. In ceramic tile areas, if a base is used it shall be a ceramic tile base.

#### *DOORS AND WINDOWS*

##### *Door Finishes*

Depending on door quality interior doors shall be painted or stained. If painted, door color shall coordinate with door frame or trim and with base mould. Painted metal frames should be consistent throughout the facility. The color shall be coordinated in tone with the wall and floor colors. If stained wood doors are used the species and finish should be consistent throughout the entire facility.

##### *Door Hardware*

All interior hardware shall be brushed aluminum finish and consistent throughout the entire facility. Miscellaneous door hardware associated with bronze anodized aluminum storefront entrances should match the door frame finish.

Armor, kick and mop plates shall be stainless steel, 0.050" (U.S. 18 Gage).

Exposed rubber parts on holders, stops and bumpers shall be grey.

All locks shall be manufactured by Best Lock Corporation. All locksets, exit devices and padlocks shall accept the same interchangeable cores.

##### *Windows*

Window treatments shall be 1 inch metal or vinyl blinds, horizontal or vertical, neutral in color and coordinated with the overall interior color scheme. In no case should blinds be of a reflective metallic color. Dark blinds matching the anodized finish of the window frames are acceptable on windows with reflective glass only. Dark blinds generate significant heat gain when exposed to harsh desert sun conditions.

Windows shall have black-out panels, rod operated from one side only.

#### *FURNISHING STYLES*

Traditional style interiors and furnishings (executive wood) shall be limited to officer levels O-6 and above. These areas shall include the Commander's office suite (deputy/executive, secretary and conference room).

Southwestern style interiors may be used in Non-Appropriated Fund (NAF) facilities or temporary living quarters.



A

DESIGN COMPATIBILITY STANDARDS

Contemporary style furnishings shall be used in all areas not mentioned above.

Although exceptions may arise, in general, commercial grade furnishings should be used in all facilities.

#### *SYSTEMS/PRE-WIRED WORKSTATIONS/MODULAR FURNITURE*

**P**anel fabrics are to be either brown-tone or grey-tone neutrals. Work surfaces, flipper doors, etc. shall complement fabric panels. Only one type of system furniture should be used per building to provide continuity and to allow flexibility in reconfiguration as occupants, needs and requirements change. System furniture should be installed over carpet tiles. Removal of roll stock carpet requires dismantling and storing and reinstallation of

systems furniture. Carpet tile will allow for self-help replacement. Carpet tile will also allow flat wiring for power and communications under the carpet.

#### *MISCELLANEOUS ACCESSORIES*

**F**ire protection accessories (horns, panels, cabinets, alarms) shall be factory finish white unless required to be red by fire code.

Electrical switch plates, receptacles, communication plates and covers shall be ivory colored unless otherwise dictated by special design features or applications.

Placement of thermostats, fire extinguishers and visible devices shall be coordinated with the interior design.

Lighting fixtures shall be aesthetically coordinated into the overall interior design scheme. Task lighting and similar designs are encouraged to reduce glare and impact on eyes.



*B*

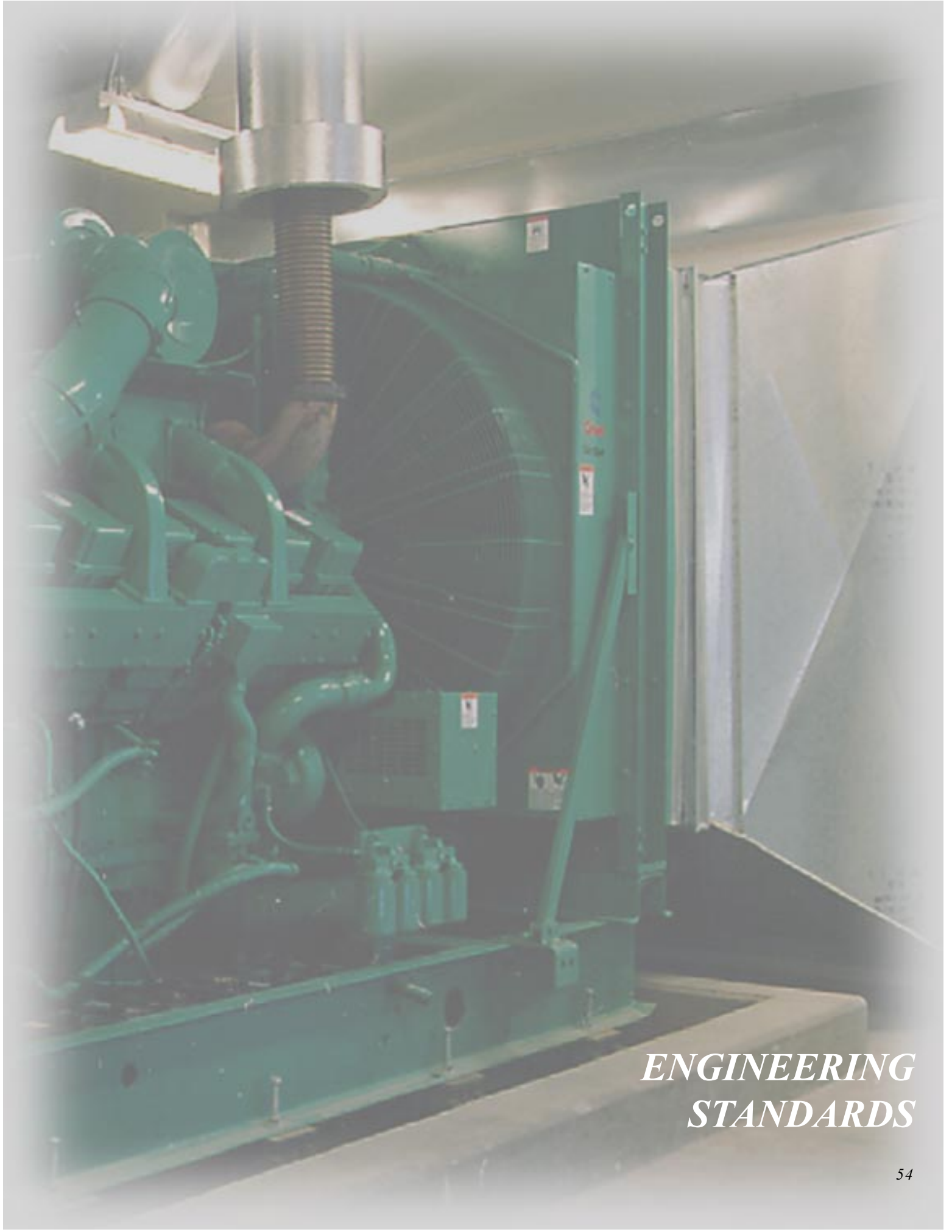
*DAVIS - MONTAN AIR FORCE BASE TUCSON, ARIZONA*

*A. Functional finishes - concrete floor; sealed and painted CMU walls - are appropriate for mechanical equipment rooms.*

*B. Typical systems workstation installation*







*ENGINEERING  
STANDARDS*

## MECHANICAL DESIGN

### GENERAL STANDARDS

**I**n new buildings or buildings undergoing major renovation, an appropriate, well-lighted mechanical room, or rooms will be provided. Chillers and boilers may be installed in walled mechanical yards or enclosures. Provide switchable lighting inside the enclosure for night repairs. For facilities undergoing major renovations, especially roofing renovations or repairs, relocate existing roof-mounted mechanical equipment to be ground-mounted to the greatest extent possible.

Clearances surrounding all mechanical equipment will be clearly shown on drawings and will be adequate on all sides to allow for maintenance, repair, and replacement of the equipment. Clearances shall account for and be in addition to clearances required for adjacent items of equipment and obstructions mounted on enclosure walls.

Provide screen walls around mechanical equipment in accordance with these and the base standard architectural guidelines.

Provide a suitably thick concrete floor, separate from equipment pads, on the interior of the entire equipment enclosure. Equipment pads will be appropriately isolated from the adjacent concrete floor.

Provide equipment pads eight inches wider than the equipment in all directions, except the compressor side. On the compressor side, provide equipment pad 36-inches wider than the equipment. Also, provide an 8-foot wide, access gate through the enclosure wall on the compressor side.

For chillers, provide equipment pads 36-inches wider than the equipment on all sides.

If equipment other than that specified on the drawings is proposed, require in the specifications that the Contractor provide a revised layout for approval, which maintains the clearances specified above.

Provide hose bibbs near all towers for maintenance personnel.

Provide 120/220-volt convenience outlets at each enclosure for exterior mechanical equipment.

Maintenance access shall be given high-priority consideration in system and equipment selection and layout. Install air handling units in equipment rooms where possible. If air handling units are installed high overhead or above suspended ceilings, provide a working level platform with suitable clear working space and access ladders or stairs. Ensure clearances are provided for filter

servicing, fan shaft and coil removal, tube pulling and cleaning, and similar work. Locate terminal devices over common use areas where possible to reduce interference with building occupants, especially for unit commanders, during maintenance activities. Do not use roof-mounted equipment.

All projects shall include meters to measure consumption of water, natural gas, electricity, etc. Also, when single systems are larger than 25 tons or 300,000 BTU per hour, meter the process separately. Air Force Engineering Technical Letter (ETL) 94-2 governs.

No asbestos-containing materials shall be allowed or specified.

New or replacement refrigeration equipment shall use CFC-22 or other suitable, non-CFC refrigerant rather than chlorofluorocarbon refrigerants.



B



A

Compliance with the Pima County Model Energy Code shall be required. Equipment standards can be met by compliance with the EPA's Energy Star program. Generally, for DMAFB, the building envelope can be achieved by using a minimum R-19 wall insulation and minimum R-30 ceiling/roof insulation. Provide the calculations of the thermal transmission values as part of the Design Analysis.

CO<sub>2</sub> monitors shall be installed in all new construction and major renovations.

### DESIGN ANALYSIS

Minimum requirements are as follows:

- List of applicable codes governing design and used for guidance.
- Detailed cooling and heating load calculations using commercially-available computerized software. Include actual personnel loads; actual lighting loads, not watts per square foot (SF); and actual equipment loads where known. Submit a complete report with interpretive sheets as necessary.
- Proportioning of cubic feet per minute (CFM) based on area is not acceptable.



C

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

- Selection of air handlers shall include a calculation of system static pressure losses.
- Sizing of equipment based on the size of existing equipment is not acceptable.
- Detailed equipment selection for each item.
- Cut sheets clearly depicting the essential elements of information for each item selected, legibly marked to show the item intended for use.
- Selection of pumps shall include a calculation of system head. Pumps shall be sized and specified to be non-overloading under all conditions.
- Submit the analyses required by ETL 94-4 for Design Energy Usage for new and renovated facilities.

### MECHANICAL SPECIFICATIONS

Use CSI format specifications edited to specific project requirements.

Air devices shall be specified as follows:



D

- A. Unacceptable! Provide screen walls around mechanical Equipment.
- B. Acceptable. CMU screen walls hide equipment.
- C. Provide 120/220-volt convenience outlets at mechanical enclosures.
- D. Acceptable ceiling diffuser.



### *Ceiling Diffusers*

Perforated face with fully-adjustable pattern and removable face; fabricated of steel with baked enamel finish; round neck adapter, if required; provided with opposed blade damper; Krueger series 1100 or approved equal.

### *Ceiling Return and Exhaust Grilles*

Extruded aluminum frame containing a fixed core of 1/2-inch x 1/2-inch x 1/2-inch fabricated aluminum squares; baked enamel finish; provided with opposed blade damper only for ducted return or exhaust systems with multiple grilles; Krueger series EGC-5 or approved equal. Grilles in T-bar type ceilings shall be either 10-inch x 22-inch or 22-inch x 22-inch.

### *Supply Grilles*

Vertical front with horizontal rear deflection blades, spaced on 3/4-inch centers, individually adjustable front and rear, 1-1/4-inch margin frame with countersunk screw mounting; fabricated of aluminum extrusions with factory clear lacquer finish; provided with opposed blade damper; Krueger series AL5880V or approved equal.

### *Return and Exhaust Grilles*

Vertical front deflection blades, spaced on 3/4-inch centers, individually adjustable, 1-1/4-inch margin frame with countersunk screw mounting; fabricated of aluminum extrusions with factory clear lacquer finish; provided with opposed blade damper; Krueger series AL580V or approved equal.

### *Temperature Controls and Energy Management*

Existing central Energy management and Control System (EMCS) is Williams Electric Co. Model 3000.

However, the base is in the process of converting to Staefa Direct Digital Control (DDC) controls. All new HVAC systems in excess of 15 tons shall be provided with Staefa DDC controls. Standard control diagrams and specifications shall be provided to the A-E by the Project Manager of the Engineering Contracts Element, phone (520) 228-3216.

Temperature controls will be used to the fullest extent consistent with economy of operation. They will be adequately protected against unauthorized adjustments or tampering (locking covers).

Where packaged units are provided, provide electronic programmable thermostats with seven-day time clocks for each unit. Insure supply fans run continuously. Provide capability to blow down mechanical equipment on a daily basis.

Use dry-bulb temperature controls for economizer cycle operation in lieu of enthalpy control.

### *Miscellaneous*

Where utilized, air driers for existing pneumatic control systems shall be the refrigerated type. In general, new pneumatic control systems shall not be used.

Circulating pumps for closed hot-water and chilled-water systems shall have mechanical seals. Provide two sets of spare seals for each pump supplied.

Air filters (roughing and pre-filters) shall be permanent-frame, renewable media, panel type.

Evaporative coolers shall be the aspen-pad type. Provide bleed system.

Use high efficiency motors for all applications 2 HP or greater. Follow

the guidelines in NEMA Standard MG-1.

All underground non-metallic piping shall be provided with bright-colored, continuously-printed plastic ribbon tape not less than 6-inches wide by 4-mil thick. Tape shall include a magnetically detectable conductor and be manufactured for direct burial service.

Do not use direct drive fans unless belt drive is not available due to small size. If direct drive fans must be used, provide variable-speed controls except in small bathrooms/restrooms with a single water closet.

### **STANDARD DETAILS**

The Base standard design details are available on floppy disk in AutoCAD format from the Project Manager and shall be incorporated into the design wherever they are applicable.

# HEATING, VENTILATION AND AIR CONDITIONING

## GENERAL STANDARDS

### GENERAL REQUIREMENTS AND ENERGY CONSERVATION

Generally, HVAC systems should be selected as indicated in the following pages for each zone. System selection should be coordinated through the Base Mechanical Design Section, (520) 228-3216, and approved before design is begun.

Provide central building heating and air conditioning systems wherever possible. Do not use heat pumps, split systems, and multiplicity of systems due to high initial and maintenance costs. Where heat pumps must be used, specify that the heat pump shall have a Heating Season Performance Factor (HSPF) of at least 7, and insure that the unit will operate down to 25° Fahrenheit.

Seasonal Energy Efficiency Rating (SEER) for air conditioners shall be at least 12. Provide plate and frame heat exchangers, with appropriate controls for remote (EMCS) start-stop in facilities with year-round air conditioning requirements and systems with water-cooled condensers.

Insulate all fluid conveying piping. Insulate all duct work carrying conditioned air through unconditioned spaces. Where thermal insulation is sole requirement, use external duct insulation in lieu of duct liner.

Recover heat from exhaust air if cost efficient. Minimum SEER = 12.0 for residential only, minimum COP - 2.5.

VAV Systems shall be allowed.

Humidifiers shall be of the infrared type. Canister-type humidifiers shall not be used.

## HEATING

Heating throughout the base, at present, is accomplished with gas fired furnaces, gas fired boilers or electric heat pump systems. The transfer medium is either hot air or hot water. Presently there is equipment outside or on buildings which does not enhance the appearance of the structure.

Provide boiler water testing sample points on all hot water systems. Provide chemical feeding systems on all hot water heating systems. Provide automatic pilotless ignition systems on all gas fired equipment. Install thermostats on heating supply and return lines. Install pressure gauges with valves on suction and discharge lines to all pumps. Install gas pressure gauges with valves on all gas trains on boilers.

Controls shall be as indicated under mechanical specifications. Heating systems shall be provided with a control for positive cut-off above 65 degrees Fahrenheit outside temperature.

Solar heating systems are to be studied when the base indicates that budgeting conditions are favorable.

Design conditions shall be per AFM 88-29 as follows:

Latitude	32 ° 11 ' N
Longitude	110 ° 54 ' W
Elevation	2,654 Feet
Heating Degree Days	1,574
Winter Design	@ 97.5% Column 33 ° F Outside

The fuels available for use are gas for furnaces and boilers, and solar if the basic Scope will allow.

The equipment selection should be based on the system selected should provide the most energy efficient combination.

Equipment types to be used:

Type-1 Boilers shall be jacketed, sectional cast iron type with solid state electronic flame safeguard protection and appropriate flame response time.

Type-2 Heat exchangers shall be frame type or plate type.

Type-3 Circulating pumps shall be centrifugal base mounted, in-line horizontal or vertical.

Type-4 Unit heaters shall be horizontal or vertical.

Type-5 Air handling units shall be blow through or draw through packaged type.

Type-6 Fan coil units shall be horizontal, vertical or through the wall type.

Type-7 Radiant heaters shall be gas fired.

Applicable Equipment Types:

Zone-1 Type-1, 2, 3, 4, 5, 6 and 7

Zone-2 Type-1, 2, 3, 5 and 6

Zone-3 Type-1, 3, and 6

Zone-4 Type-1, 2, 3, 4, 5, 6 and 7

## COOLING

**M**echanical refrigeration is presently used, in general, for living quarters, office buildings, dining halls and clubs, hospitals and clinics and shop areas with equipment requiring a controlled environment.

A small central heating or cooling plant should be studied for every project.

Cooling towers may be used on large systems. Evaporative coolers shall be installed at the 2 to 3 foot level, not on the roof. Select air cooled condensers based on 105 Degrees Fahrenheit ambient. Avoid the use of centrifugal chillers. A central mechanical system shall normally be provided unless specific engineering cost analysis indicate sub systems to be more economical. Locate equipment designed to operate outside behind architectural screening. Avoid locating outside equipment near the main entry of buildings.

Equipment location, access for servicing, and controls shall be as indicated in the mechanical specifications.

Design Conditions shall be per AFM 88-29 as follows:

Latitude 32 ° 11' N  
Longitude 110 ° 54' W  
Elevation 2654 Feet  
Summer Design

101°F Drybulb  
72°F Wetbulb Outside  
75°F Drybulb 50% RH Inside  
Mean Daily Range 26°F

Solar heat gain calculations shall be prepared for all building construction at Davis - Monthan Air Force Base.

Fuel: Mechanical refrigeration shall be fueled by electricity or natural gas.

Equipment: Shall be suitable for the

application.

Type-1: Chillers shall be per table of recommended units, the Facility HVAC Matrix, at the end of this section.

Type-2: Evaporative coolers shall be horizontal or vertical discharge closed circuit type or cellulose material impregnated with antirot salt and rigidifying saturants. Media efficiency shall be 76% at 600 FPM face velocity with no entrainment of pad water. Open evaporative coolers shall be designed to provide and indoor temperature of 80 Degrees Fahrenheit.

Type-3: Circulating pumps shall be centrifugal base mounted, in-line horizontal or vertical.

Type-4: Air handling units shall be blow through or draw through packaged type.

Type-5: Fan coil units shall be horizontal, vertical or through wall type.

Type-6: Heat pumps shall be horizontal or vertical split system type. Use and type shall be as indicated under Heating and Cooling, General Requirements and Energy Conservation.

Applicable Equipment Types:

Zone-1: Type-1, 2, 3, 4, 5 and 6  
Zone-2: Type 1, 2, 3, 4, 5 and 6  
Zone-3: Type 5 and 6  
Zone-4: Type-1, 2, 3, 4, 5 and 6

Minimum outdoor air requirements for ventilation shall be as indicated in Table 2 of ASHRAE Standard 62. These requirements shall be met through building pressurization and introduction of outside air at the air handler. Infiltration is not an acceptable method of providing outside air.

Generally, use ducted supply and plenum return air systems for air conditioning utilizing central-station-type air handling units with economizer air cycles. Use ducted returns only where not able to use plenums and only for constant volume systems. Normally return fans are not required; verify that return fans are actually required before including them



A



B



in the design.

Fire dampers shall be specified with blades out of air stream.

Roofs should not be “cluttered” with mechanical equipment. Locate mechanical equipment in equipment rooms or on the ground on equipment pads. When units are set outdoors, do not run ductwork up building walls or across roofs.

Ductwork should extend from the unit directly through the wall or roof. Provide hoods over the flex connection between the unit and the ductwork. Paint the hoods and all exterior ductwork to match the building finish.

Variable speed drives shall be used for VAV systems in lieu of inlet vanes or bypass dampers whenever possible.

Utilize “Griswold” type flow control valves for all chilled and heating water coils.

Exhaust outlets and outside air inlets should be located on vertical surfaces rather than through roofs. Place elements strategically out of view, or organize aesthetically, grouping elements of equal size and spacing.

Splitters in ductwork are not allowed. Use round (or low aspect ratio) duct over square.

Round, flexible duct should be the same size as the diffuser to which it is connected. In other words, an 8x8 diffuser should be supplied with an 8-inch diameter flexible duct.

#### STANDARD DETAILS

The Base standard design details are available on floppy disk in AutoCAD format from the Project Manager and shall be incorporated into the design wherever they are applicable.



C

DAVIS - MONTHAN AIR FORCE BASE TUCSON, ARIZONA

- A. Acceptable application of ductwork installed “thru-wall”. (Unacceptable screening of equipment, however!).
- B. Uncluttered roof.
- C. Unacceptable! Rooftop equipment and vents visually clutter a roof and are subject to leaks.

# FACILITY HVAC MATRIX

DX COOLING/GAS HEATING PACKAGED UNIT - SINGLE COMPRESSOR
DX COOLING/GAS HEATING PACKAGED UNIT - MULTIPLE COMPRESSOR
AIR-TO-AIR PACKAGED HEAT PUMP
WATER-TO-AIR PACKAGED HEAT PUMP
AIR-COOLED CHILLER - SINGLE COMPRESSOR
AIR-COOLED CHILLER - MULTIPLE COMPRESSOR
EVAPORATIVE-COOLED ROTARY COMPRESSOR PACKAGED CHILLER
WATER-COOLED ROTARY COMPRESSOR CHILLER
WATER-COOLED RECIPROCATING CHILLER - MULTIPLE CHILLER
FORCED-DRAFT COOLING TOWER
INDUCED-DRAFT COOLING TOWER
CONSTANT VOLUME SINGLE ZONE AIR HANDLER
CONSTANT VOLUME MULTI-ZONE AIR HANDLER
VARIABLE VOLUME AIR HANDLER
NO ECONOMIZER - MINIMUM OUTSIDE AIR
DRY BULB MODULATING ECONOMIZER CYCLE
EVAPORATIVE COOLING
GAS-FIRED CAST IRON BOILER
GAS-FIRED FORCED AIR FURNACE
GAS-FIRED UNIT HEATERS
TWO-PIPE UNIT HEATERS

## KEY

\* PREFERRED SYSTEM  
A ALTERNATE SYSTEM

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LESS THAN 7-1/2 TONS
7-1/2 - 12-1/2 TONS
15 - 19 TONS
20 - 39 TONS
40 - 59 TONS
60 - 99 TONS
100 - 119 TONS
GREATER THAN 120 TONS

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SHOP AREAS (NO AC)
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REMOTE AREAS (NO GAS AVAIL)
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DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	FACILITY HVAC MATRIX	CHECKED BY	J. BARKER	DETAIL NO DM-S 004
		SCALE	NONE	
		DATE	21 MAR 91	

## PLUMBING

### UNDERGROUND PLUMBING

#### GENERAL

The soil at Davis-Monthan Air Force Base is underlain with well drained soils of fine loam and sand. The water table varies from 200 feet to 400 feet below the ground surface.

Meter all utilities on new structures.

#### WATER SUPPLY

Water piping shall be designed for a maximum velocity of 3 fps, or manufacturer's recommendation, whichever is less. Plastic piping shall be pressure pipe capable of withstanding 165 psi. Trenching, backfilling, and pipe installation shall be done according to manufacturer's recommendations. Pipe shall have minimum cover of three (3) feet.

Connection to main: Provide separate connection to water main for fire protection and domestic water systems.

Service line connections to existing mains shall be pressure or hot-tap, with service valve at or near connection to main. Provide brass directional markers at the service valve.

Underground water service piping less than 4-inches in diameter shall be black AWWA C901 polyethylene plastic with ASTM D2657/D3261 butt fusion fittings and joints and pre-manufactured anodeless service risers. Use 1-inch and 2-inch sizes only.

Underground water mains 4-inches and greater shall be AWWA C900, Class 150 PVC with AWWA C111, cast iron fittings and ASTM D3139 compression gasket ring joints. Use even sizes only.

Do not route water service piping

underground beneath the building slab.

Generally, when bringing the domestic water line into the building, it is not necessary to construct an in-line, underground shutoff valve (SOV) in a handhole outside the building, with the water line then rising into the building. It is acceptable to install an SOV in the riser, then into the building.

Use only Type K or L copper piping for the domestic water piping inside facilities. Non-domestic water supply piping may be Chlorinated Polyvinyl Chloride (CPVC) or Polyvinyl Chloride (PVC).

All valves in copper piping must be threaded.

Dielectric unions shall be used where and as needed.

The mechanical make-up water system shall have a separate air gap type (10 gallon tank and float with pressure actuated gear driven pumps) backflow prevention device.

#### SANITARY SEWER and STORM DRAINAGE

Sewer lines shall be installed according to manufacturer's recommendations with not less than a 2.5 fps hydraulic velocity flow; minimum main from building shall be 4 inch.

Sewer manholes shall be precast reinforced concrete manhole sections with two exterior coats of heavy duty bituminous. Manholes shall conform to ASTM C478-72. Position manholes at every 45 degrees and 90 degrees, and a minimum of 300 feet apart.

Provide a two-way ground cleanout (GCO) on all sewer - soil or waste-lines which enters the building (refer to standard details).

Waste, Vent, and Drainage Piping shall be one of the following: Acrylonitrile-Butadiene-Styrene (ABS), Polyvinyl Chloride (PVC), Polypropylene (PP), or Filament-wound Reinforced Thermo-setting Resin (RTRP), or Cast Iron, Service or Extra Heavy.

#### NATURAL GAS

Gas lines shall have maximum working pressure 60 PSIG.

Underground gas piping shall be medium-density, yellow, ASTM D2513 PE 2406 SDR11 pipe category CEC polyethylene plastic with ASTM D3261 butt fusion fittings and joints and pre-manufactured anodeless service risers. Use only 1-inch, 2-inch, 4-inch, 6-inch, and 8-inch underground gas piping.

Service line connections to existing mains to be pressure or hot-tap, with service valve at or near connection to main. Provide brass directional markers at the service valve. Provide locking cover on the valve box.

Building gas service regulators for reduction from medium pressure (30-35 PSI) service to 5 - 8 inch w.g. will be installed outside of buildings with piping rising to above grade before entering building. Provide plug cocks on inlet and outlet of regulator/meter assembly with provisions to remove meters for service with minimum downtime.

Select new service regulators to include the following features: internal high pressure relief, manual reset low pressure cutoff, and orifice size, spring range, and date of manufacture stamped on the outer casing. Provide gas meter directly downstream of regulator. Provide parts listing and service/repair instructions for gas regulator and meter.



Do not route gas piping underground beneath the building slab.

Building gas service regulators for reduction from medium pressure (30 – 35 psi) service to 5 – 8 inch w.g. will be installed outside of buildings with piping rising to above grade before entering building. Select new service regulators to include the following features: internal high pressure relief, manual reset low pressure cutoff, and orifice size, spring range and date of manufacture stamped on the outer casing.

Provide gas meter directly downstream of regulator. Provide parts listing and service/repair instructions for gas regulator and meter.

Provide plug cocks on inlet and outlet of regulator/meter assembly with provisions to remove meters for service with minimum downtime. Service line connections to existing mains to be pressure or hot-tap, with service valve at or near connection to main.

## ABOVEGROUND PLUMBING

### GENERAL

In buildings normally occupied by more than 15 persons, provide separate toilet rooms for each sex; position them together and use a common wall for plumbing chase.

In buildings occupied by 1 to 15 employees, a single toilet to serve both sexes may be provided.

Furnish minimum plumbing fixtures as indicated in UPC.

Approved piping materials are as follows:

- Water Supply Piping shall be PVC/CPVC suitable for transporting water above 150 degrees

## TABLE OF RECOMMENDED PLUMBING FIXTURE TYPES:

**Zone 1:** Mission

**Zone 2:** Mission Support

**Zone 3:** Family Housing

**Zone 4:** AMARC Zone

	ZONE			
	1	2	3	4
Water Closets	1, 2	1, 2	3	1, 2
Lavatories	4	4	5	4, 5
Urinals	7	7	-	7
Sinks (Kitchen)	-	8	8	8
Sinks (Service)	-	9	9	9
Sinks (Food Service)	-	10	10	-
Sinks (Medical)	6	6	6	-
Water Coolers	-	11	11	11
Showers	12	12	12	-
Bath Tubs	-	13	13	-

Fahrenheit.

- Compressed Air Supply Piping shall be copper with copper cast fittings.
- Waste and Vent Piping shall be PVC/CPVC or C.I.
- Drainage Piping shall be PVC/CPVC or C.I.
- Gas Piping shall be Schedule 40 steel.

Provide floor drains in every area that has a water closet. Provide a hose bibb to prime trap. Do not use trap primers.

Generally, combine vents from different stacks throughout the facility and provide only a single vent-thru-roof for entire facility.

## PLUMBING FIXTURES

### GENERAL

Energy conservation washerless fixtures shall be all metal construction, no chrome-plated plastic. All techniques shall be considered, including 1 GPM flow restrictors for faucets, 3 GPM low-flow shower heads,

single control mixing type faucets, low volume flush water closets, 3 gallons or less, and self-closing faucet valves. Showers shall have valves with pressure balance feature. Utilize freezeless wall hydrant. Provide interior wall access (self-draining) with hose attached. Wall mounted drinking fountains are preferred.

All applications of plumbing fixtures shall be considered for handicapped usage as directed by Air Force Guidelines.

Do not utilize low volume or water conservation-type water closets for AMARC projects.

The table in this section suggests plumbing fixture types for the four functional zones. The fixture types are listed below:

### PLUMBING FIXTURE TYPES:

- Water Closets - Flushometer valve as specified below, siphon jet, elongated bowl, top supply spud, floor or wall mounted. Seat: plastic, elongated, open front.

2. Water Closets (handicapped) -  
Top rim of bowl shall be 18 inches above the floor. All other characteristics shall be the same as #1 above.  
  
recessed. Enameled cast iron, porcelain enameled. Formed steel, plastic without wall, plastic with high wall.
3. Water Closet - Flushometer valve as specified below, siphon-jet, elongated bowl, flush tank, floor mounted. Seat: Plastic, elongated, open front with seat cover.  
  
Flushometers shall be specified as Sloan Royal water-saving flushometers, or approved equal, to match the base standard.
4. Lavatories - Enameled cast iron or vitreous china. Faucet: As required below.  
  
*FIXTURE FAUCETS:*  
  
Fixture faucets shall be specified as:  
  
Delta Model 300WF for kitchen applications.
5. Lavatories - Enameled cast iron or vitreous china, counter top. Faucet: As required below.  
  
Model 101WF or 570WF for lounge sink applications.
6. Wheelchair sinks - Vitreous china, 20 inches by 27 inches deep.  
  
Model 2121HDF for janitor sink applications.
7. Urinal - Wall hung. Siphon-jet or washout. Flushometers as specified below.  
  
Model 520WF (Model 515WFHDF for handicap) for lavatory applications.
8. Kitchen Sinks - Single or double bowl, ledge back with holes for faucet and spout, stainless steel. Faucet: As required below.  
  
Model 623 for shower applications.  
  
Model 643 for bathtub applications or approved equal to match the base standard. The approved equal shall use the same repair kits as the Delta faucets.
9. Service Sinks - Enameled cast iron. Trap standard, wall mounted or floor mounted. Faucet: As required below.
10. Food Service - Stainless steel with drain board. Faucet: As required.
11. Water Coolers - Self-contained. Exposed surfaces shall be stainless steel. Wall mounted surface. Wall mounted semi-recessed. Wall mounted recessed. Handicapped. Free standing.
12. Showers - Wall mounted for stall or bath tub. Valves: As required below.
13. Bathtubs - Straight front

## **ELECTRICAL DESIGN**

### **DESIGN ANALYSIS**

**M**inimum requirements are as follows:

Short-circuit and fault calculations study.

Voltage (V) drop analysis study.

Load calculations for new and existing.

Coordination study: a minimum of two, coordinated ground fault levels are required for 480V system, with electric service of 1000 AMP (A) and more.

Foot-candle analysis. The goal is to achieve an illumination efficiency of 1.5 watts per square foot.

### **DRAWINGS**

**M**inimum requirements are as follows:

Electrical site plan, accurately scaled, showing the following:

All exterior electric from the pole to the pad-mounted transformer to the electric service.

All communication lines.

Wire and conduit sizes.

Reflected ceiling plan.

Lighting plan.

Power plan, panel schedule showing minimum 30% spare space.

Communication (voice, data) plan with riser diagram.

Fire alarm plan with fire alarm riser diagram.

Details, showing grounding, trenching and backfilling, pad mounted transformers, existing poles, modified poles including grounding, and other details as required by the project. See standard details.

Electrical power riser diagram, including wire and conduit sizes.

One line diagram showing new and existing, the coordination, and at least three fault points.

Load calculations and tabulations.

### **STANDARD DETAILS**

**T**he Base standard design details are available on floppy disk in AutoCAD format from the Project Manager, and shall be incorporated into the design wherever they are applicable.

### **GENERAL STANDARDS**

**F**or new electric service, 480V, 3-phase (Ø) service is preferred.

All new electric service shall be in the mechanical/electrical room.

All service entrances shall be underground, from the high voltage poles, and shall be stepped down by using pad-mounted transformers.

All new facilities or major renovation projects shall include LCD-style KWH meters for measuring energy consumption and which shall be capable of connection to the EMCS system.

Provide standardized prewiring, receptacle, conduit, and ductwork for telephones, office automation equipment, and Energy Management Control System.

Wire size. The minimum wire size shall be No. 12 AWG copper in ½-inch diameter conduit per circuit.

Switch gear shall be full copper bus with a KWH meter. Panel boards shall be copper bus sized with 30% more for future expansion.

Base primary voltage line is 13.8KV, 3-Ø delta.

Wall switches. Quiet, slow make, slow break design, toggle handle with totally enclosed case, rated for 20 AMP and voltage as required.

Duplex receptacles. Full gang size, polarized, duplex, parallel blade u-grounding slot, hospital grade, rated 20 AMP, 125 volts, designed for split feed service.

Interior conduit: EMT or as required for explosion-proof construction. Conduit filling shall be per NEC (National Electrical Safety Code). When using NEC-approved wiring, conduit is not required in base housing.

High voltage cable (primary) must be EPR with 133 percent insulation.

Sizing of Neutral. Follow the FIPS 94 guidelines to account for adjustable speed drives, automatic data processing and other electronic loads.

Surge Suppression. Provide surge suppression to protect against harmonic distortion and transients in critical or mission essential areas. Provide dedicated circuits for computers.

Parking Stations are required whenever load break elbows are specified for switchgear or manholes.

### **UNDERGROUND ELECTRICAL**

**T**he primary voltage is 13.8KV. The secondary is 480/277V or 208/120V and in some cases 240V.

Underground electrical distribution shall be PVC duct encased in concrete 36 inches below grade with warning tape 12 inches below finished grade. For secondary distributions, use rigid PVC, 24 inches below grade. Provide one (1)



spare conduit. Use “stirrup” connectors to connect service feeders to overhead conductors.

Although underground metallic piping is not usually allowed on DMAFB, where specifically approved, cathodic protection and bonded protective coatings shall both be applied to the following buried or submerged metallic items:

- Piping for natural gas, oxygen, or liquid fuels.
- Fire protection system piping.
- Ductile or cast iron piping under slab.
- Heating or cooling water lines.
- Storage tanks.
- Sewer and water lines.

**Design Conditions:** The design of underground distribution systems shall be based on the calculated demand with sufficient electrical capacity for expansion if allowed or if within the budget.

**Materials:** The materials as indicated above shall be rigid, heavy duty plastic conduit encased in concrete. Allowable plastic conduits include PVC, fiberglass or similar nonmetallic electrical duct.

**Wiring.** For underground or damp locations, use XHHW insulation rated for 600V and 75 insulation rated for 600V and 75 degrees Fahrenheit.

All underground cable terminations to equipment shall be loadbreak/non-loadbreak elbows with grounding kits. Underground secondary distribution shall have junction boxes with load breaks, not manholes.

**Primary Manholes,** at a minimum, shall:

- Utilize a four-point junction.
- Contain a spare junction for a future

circuit, with proper safety caps.

#### *ABOVEGROUND ELECTRICAL*

**Overhead Transmission and Distribution Lines:** There currently exists, in some areas of the base, overhead transmission and distribution lines. Future overhead electrical distribution shall be kept to a minimum.

If used, the poles for this system of distribution shall be sized to handle the application and shall be concrete or wood pressure treated with creosote. Concrete poles shall be reinforced or prestressed either cast or spun.

Crossarms for wood poles shall be solid wood, distribution type and shall be sized for the intended load.

Underbuilt services such as low voltage distribution or communications distribution running on the same pole system shall be installed per NEC.

Vertical phases for directional changes of the aerial distribution shall be consistent with the base standard and per NEC.

Lightning protection for aerial distribution shall be through the use of combination static and neutral wire.

**Motors:** All motors of 5HP or larger shall have single phasing protection of the type that trips when the phase angle between the three phases is not 120 degrees or on an undervoltage condition. All motors of 50HP or larger shall utilize soft start type.

**Site Lighting:** Site lighting shall continue to exhibit continuity throughout the Base. See Landscape Design Standards, Section 12, for lighting fixture standards.

**Grounding:** Provide separate grounding conductors and rods for surge (lightning) arrestors and service neutrals. Provide insulated grounding conductors to all grounding type outlets. Metallic conduit shall not constitute a safety ground. Include the following in specifications:

“Use three-point ground test and instrumentation. Perform test in presence of government inspector. Submit results and indicate type of test performed.”

**Transformers:** Provide service transformers with delta primary and wye secondary connections for three phase services. All service transformers shall have two 2 - 2 1/2 percent taps above and below rated voltage. Provide low %z transformers where short circuit currents permit. Screen all exterior transformers from major circulation routes or common areas.

The primary side of transformers shall be 13.8 KV delta and secondary as required.

**Transformers.** Liquid-filled, copper-wound, PCB-free, pad-mounted, dead front, loop-feed with lightning protection, dry-well current limiting fuses, group internal high voltage switch, and 2 - 2 1/2 percent taps above and below rated voltage. Consider “K” factor.

**Panelboards:** Provide typed panel schedules. Provide manual bypass for all auto transfer generator panels.

Emergency lighting in shops and offices shall be ceiling mounted, no wall packs or bug eyes.

## INTERIOR POWER

**Wiring:** For indoor locations, use THHN insulation rated for 600V and 75 degrees.

**Wiring Devices:** Provide new devices and plates whenever an area is renovated. All devices shall be recessed except in mechanical rooms and utility areas. Provide devices rated at 20A or greater. All wiring shall be copper. No aluminum allowed.

**Automatic Controllers:** Provide battery backup for lawn sprinkler system controllers and automatic setback thermostats.

**Overcurrent Protective Devices:** The minimum sized overcurrent device for branch circuits is 20 amps. Ensure proper coordination and withstand ratings for all overcurrent protection devices. Demonstrate coordination with first upstream existing protective device. Replace old circuit breakers with new when remodeling facilities. If replacement breakers are unavailable, consider replacement of entire panel board. Main fusing is acceptable for limiting short circuit currents; however, place a box with one full set of spare fuses adjacent to main panel.

**Electrical Identification:** Provide plastic panel board and disconnect labels. Labels shall be laminated (black with white core) engraved with 1/4 inch high letters. Attach to front exterior of enclosures. Labels shall match plan designations. Provide non-ferrous phase and circuit identification labels in all enclosures for feeder circuit conductors. Provide underground marker tapes for all underground conductors. If underground conductors are not in metallic conduit, provide marker tape with foiled backing to facilitate detection.

**Power Factor Correction:** Add power factor (p.f.) capacitors to induction

motors (10 HP or larger) to correct p.f. to 0.90 (+.05, -.00). Switch p.f. capacitors in with the motor. Size capacitor IAW IEEE 141, NEMA MG2 and motor manufacturer recommendations.

**Power Service:** Power requirements for buildings shall be 208/120 except 480/277 based on building function as an exception.

**Electrical Related Work:** Balance loads on phases within 10% at all panel boards. Conduit fault calculations to ensure proper withstand ratings for all protective devices. Ensure coordination for all protection devices, conductors, enclosures and equipment.

**Raceways:** Conduit run in concrete shall be PVC unless steel conduit is needed for a specific reason, i.e. to limit fault currents. Underground primary voltage feeders shall be in concrete encased conduit.

All penetrations of fire resistance rated walls shall be fire stopped IAW NEC Article 300-21. Highlight compliance with NEC Articles 300-5(g) and 300-7(l) regarding moisture seals.

**Conductors:** Aluminum conductors may not be used. The smallest branch circuit conductors acceptable are No. 6 AWG and larger shall have heat resistant insulation.

**Conduits:** All new utility lines shall be

run in underground conduit. Provide spare conduits from transformer to building.

All conduit and cabling to be concealed (phone, electrical, computer, etc.).

**Meters:** Meters shall be generally located in rear of building or near service entrance and shall be on all new and remodeled buildings.

All new buildings shall have lightning protection designed into the project.

Electrical panels to be painted to match or to coordinate with interior color scheme or specified with appropriate factory finish.

## LIGHTING

Provide wire guards for all open fluorescent lamps. Utilize energy saver 32 watt T-8 fluorescent lamps and electronic ballasts in administrative and similar areas. Use metal halide lights in bay areas, even in areas of non-critical color rendition. Provide seismic zone 2 protection for all fixtures, especially ceiling grid mounted fluorescent fixtures. Provide Certified Ballast Manufacturer (CBM) listed ballasts. All ballasts shall be electronic and shall have 0.90 power factor or greater and with a total harmonic distribution of <10%.



A



B

DESIGN COMPATIBILITY STANDARDS

Use the following guidelines to help achieve the 1.5 watts per square foot general lighting efficiency goal:

Do not use incandescents. Where spot dimming is required, use special dimming ballasts with compact fluorescents or multiple switching of circuits with compact fluorescents.

Outdoor/Exterior Lights: All outdoor/ exterior lighting shall comply with the City of Tucson Lighting Ordinance 6786. Exterior building lights shall be fluorescent fixtures. All other exterior lights shall be high-pressure sodium, with ballast, high power factor, low temperature type, reliable starting (-5 degrees F), efficacy of 105 to 120 lumens per watt. If EMCS is not available, motion detectors and photocells shall be used in lieu of switches where lights are for convenience rather than security.

Interior Lights: Use a T-8 fluorescent lighting system with electronic ballasts as the principal system within a facility. To achieve the interior lighting plan standard, consider the following:

Consider occupancy sensors, with manual control capability, for areas where occupancy is irregular or intermittent, as in conference rooms.

Consider specular reflectors for retrofit applications.



C

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Use LED-style exit lights, with nickel-cadmium-type emergency batteries. When renovating facilities with existing radioluminescent exit signs, the contractor shall turn the signs over to the Contracting Officer for proper disposal through 355 CES/CEO.

All emergency exit lighting shall be on dedicated circuits for facility connection or future connection to the EMCS system.

Hangar Lights: Metal Halide, efficacy of 105 to 120 lumens per watt including ballast losses.

- A. Unacceptable! Paint all panels.
- B. Unacceptable! Conceal all conduit and cabling.
- C. LED-style exit light.



## ***FIRE PROTECTION***

### ***GENERAL STANDARDS***

**A**ll buildings shall be equipped with an antenna to provide interface with the base fire alarm system REPCO. All cabling shall be in conduit, whether exposed or concealed.

**Design Conditions:** All fire protection design shall be per NFPA 13, NFPA 13r, Life Safety Code and Military Handbook 1008B.

**Distribution:** The underground piping systems shall be PVC. Aboveground piping systems shall be Schedule 40 steel threaded or welded. Schedule 80 copper with high temperature solder and Schedule 10 steel can also be used above ground. No thinwall or plastic piping shall be allowed as part of the fire suppression system after it enters the facility.

### ***WATER DISTRIBUTION***

Any additions to the base water system must be kept in a grid system so that no fire hydrants are located on a dead-end line.

Underground fire protection piping shall be AWWA C900 class 150 PVC with AWWA C111, cast iron fittings and ASTM D3139 compression gasket ring joints.

**Water supply.** Utilize MIL-HDBK-1008B, Fire Protection for Facilities Engineering, Design and Construction to determine minimum fire flow water demands and durations for new or upgraded facilities, and (or) the necessity for fire hydrant(s) at or near new or upgraded facilities.

**Connection to main.** Provide separate connection to water main for fire protection and domestic water systems. Service line connections to existing mains to be pressure or hot-tap, with

service valve at or near connection to main. Provide brass directional markers at the service valve.

**Alarm Systems:** All buildings shall be monitored for fire signals back to the Base Fire Stations.

### ***FIRE ALARM SYSTEMS***

**A**ll fire alarm systems must be Class "A", Style D. Fire alarm panels and transmitters must be accessible to the fire department, such as in a mechanical or electrical room, or outside the building. Fire alarm panels shall have at least two spare zones. Circuit breakers for fire alarm panels, exit lights, and emergency lights must have a locking device so occupants cannot tamper with them. Fire alarm panel and transmitter batteries must be gel cell type. Alarms shall be a combination alarm horn/strobe alerting devices.

Manual pull stations shall be the toggle switch type.

Transponders shall be receiver/transmitter radio units operating on 138.925 megahertz designed for compatibility with Repco, Inc., 2000 radio multiplex system.

Transponders shall have four input zones including fire alarm panel alarm, trouble, transponder power failure, and a spare. An exterior, wall-mounted antenna shall be installed for each transponder and shall be one-half dipole with 2.25 dB gain, Repco, Inc. part number 840-024-01, or equal.

For dormitories 3 stories or higher all areas must be sprinkled and the sprinkler system must be connected with the existing base alarm system. Dormitories shall have dual detection systems, heat/smoke in sleeping room with a local alert.

Sprinkler heads in finished ceilings shall be semi-recessed, chrome-

plated.

### ***FIRE DETECTION SYSTEMS***

**H**eat detectors are required in all areas unless the building is protected by a sprinkler system. Use 190-degree, fixed temperature heat detectors. Do not use rate-of-rise detectors.

Smoke detectors are required in electrical equipment rooms and sleeping rooms, even when the building is protected by a sprinkler system. Smoke detectors are also required in other special occupancies as required by NFPA.

Duct smoke detectors. Connect so that detectors will trigger the fire alarm system and shut down the air handler.

### ***FIRE SUPPRESSION SYSTEMS***

**S**pecifications for fire suppression systems shall include a statement requiring the design of the sprinkler system under the direct supervision of a Professional Engineer experienced in the design of this type of work and licensed in the State of Arizona. Shop drawings for fire suppression systems shall be required and shall bear the seal of that Engineer.

**Tamper Switches.** All OS&Y for fire sprinkler, deluge, and AFFF systems must have tamper switches



*A*

***DESIGN COMPATIBILITY STANDARDS***

connected into fire alarm system.

Fire Protection Riser. Comply with standard detail shown in the attachments. This detail is available on floppy disk in AutoCAD format from the Project Manager.

Post indicator valves. Do not use post indicator valves. NFPA allows the Authority Having Jurisdiction (in this case, Davis-Monthan AFB) to permit a non-indicating valve, such as an underground gate valve with approved roadway box complete with T-wrench. This is the case at Davis - Monthan.

AFFF Foam. The contractor must provide AFFF foam for projects using AFFF systems.

Electronic Equipment Installations, including major automatic data processing (ADP) areas, command centers, command and control

systems, and other mission-critical systems shall be located in buildings protected by wet-pipe automatic sprinklers. Provide complete coverage throughout the building including the electronic equipment areas. Provide pre-action type system at electronic equipment areas. Further, electronic equipment shall be protected by disconnecting the power upon activation of the fire protection system.



B

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A. Unacceptable. Surface mounted sprinkler head

B. Acceptable. Semi-recessed sprinkler head.

## MISCELLANEOUS

### SECURITY SYSTEMS

#### GENERAL STANDARDS

In order to maintain coordinated system growth, security panels shall be compatible with the Base system.

Install a 3/4 inch conduit from the security panel to the building's main telephone backboard (home run panel). Install a 24 AWG four wire Cat 5 telephone cable in this conduit.

Security panels shall have a minimum of 16 programmable zones. Door contacts will be grouped together with a maximum office door contacts per zone. Motion detectors will be grouped together with a maximum of five door contacts per zone. Under the floor or above the ceiling motion detectors or other sensors will be zoned separately. Duress alarm sensors and duct detectors will also be zones separately. Sensors on each zone are to be wired in series.

Install a separate power supply in a junction box adjacent to the security panel to power all motion detectors or other non passive field security sensors. Install conduit between the power supply junction box and the security panel. Provide 155V AC to an AC handy box inside the power supply security panel. Install a 115V AC receptacle with an ON/OFF switch in the handy box. This receptacle will be used to plug in the stepdown transformer that powers the security panel.

The keypad shall be mounted on the outside of the primary entrance into the classified area. If the keypad is mounted on a wall exposed to the elements, a NEMA enclosure with hinged cover shall be installed to protect the card reader. The enclosure will be of sufficient size to allow the user to swipe the card through the

reader.

The Civil Engineering EMCS Shop will perform all software programming necessary for the central computer to communicate with security panels.

### TELECOMMUNICATIONS

#### GENERAL STANDARDS

This section describes telephone, prewiring, computer support, and other communication requirements which must be addressed in the project design. These criteria are as follows:

New construction and remodeling projects should make provisions for conduit, outlets, lockable enclosures, power and building entrance. Locate telecommunication rooms close by electrical equipment rooms.

Telephone systems – Provide 3/4" x 4' x 8' plywood backboard in the mechanical room. Provide 120V duplex receptacle adjacent to board with a #6 AWG bare copper wire from backboard to grounding bar in panel board. Provide conduit to exterior for telephone service drop – prefer below ground access.

Pay Phones – Ensure that electrical power is provided next to all pay phones.

Wiring and Conduit (General) – Provide prewired outlets with covers for phones and computer. All cable and phone lines shall be prewired back to a central electrical space in the building. Provide 2 – 4" empty underground conduit to exterior manhole for both cable and phone.

Electrical Room – All telecommunications and electrical rooms shall be environmentally controlled.

Communication wiring shall be located in cable trays above ceilings.

All new building shall be pre-wired for telecommunication in conduit which include fire alarm, telephone and EMCS Systems.

Cable television shall require its own conduit; however, cable may be installed in same trench or duct bank.

LAN System: Category 5, 10 Base T cable. Use dual wall plates, 1 phone and 1 LAN.

### COMMUNICATIONS EQUIPMENT ROOM

#### GENERAL STANDARDS

Communications equipment room (CER). A CER is required for a facility that has significant communications/computer system requirements. Unoccupied facilities and small facilities such as guard houses, utility control buildings, storage bunkers, etc., will normally not require a CER. CER requirements are as follows:

Minimum room size shall be 8 feet by 15 feet.

Room should be located on the first floor and must have an exterior, double double-door entrance.

Room must not be collocated with electrical or mechanical equipment.

Room must be environmentally controlled.

Room shall have 3/4-inch plywood backboards on all walls, beginning one foot above finished floor and continuing to no less than seven feet above finished floor.

Provide dedicated electrical circuits



to support communications/computer system equipment. As a minimum, provide two, 20-AMP dedicated branch circuits. In addition, the room should also have receptacles on all walls in accordance with the NED.

As a minimum, provide a single point ground for all communications/electronics equipment for the building within the CER. Provide a ground riser with a No. 1 or larger wire directly connected to the provided ground plate with no taps. The resistance of the ground wire must be five ohms or less, measured from the main ground point. Grounding must meet NEC requirements.

Telecommunications closet (TC). A TC is required for each floor with 10,000 square feet of usable footage in a facility. A TC services as the interface from the CER to the individual voice/data outlets in the facility and as a location for enterprise hubs for data LAN equipment. The CER may also function as a TC for the area in the facility where it is located. TC requirements are as follows:

Minimum room size shall be 6 feet by 8 feet.

Room should be centrally located to the area it serves. The installed length of all horizontal distribution cables run from the TC to the outlets must be less than 295 feet to support LAN data requirements.

Room must be environmentally controlled.

Room shall have 3/4-inch plywood backboards on all walls, beginning one foot above finished floor and continuing to no less than seven feet above finished floor.

As a minimum, provide two, 20-AMP dedicated branch circuits. In

addition, the room should also have receptacles on all walls in accordance with the NEC.

As a minimum, provide a No. 6 ground wire connected with a direct home run to the ground plate in the CER. The resistance of the ground wire must be ten ohms or less, measured at the grounding point. Grounding must meet NEC requirements.

Telephone board (when used for unoccupied/smaller facilities which do not require a CER/TC): 4-feet by 8 feet by 3/4-inch plywood, with #6 ground. Provide receptacle on or near telephone board.

Telephone/Data Primary: Underground from the main telephone demarcation point to the telephone terminal board. As a minimum, specify two, 4-inch PVC conduits with 1/4-inch, nylon pull wire and 90-degree long sweep. One of these two conduits shall have three, 1-1/4-inch interduct. Interduct shall be orange in color to designate fiber optic cable run.

Telephone/Data Secondary: From the CER, TC, or telephone board to the telephone/data outlet. Cable between outlet and patch panel shall be continuous (no splices). The riser conduit design should include spare capacity for a second riser cable of equal size. All voice and data wiring should be at least 12 inches from parallel power runs and 2 inch from diagonal power runs.

Telephone wiring: All voice wiring shall meet minimum EIA/TIA (Electronics Industries Association/Telecommunications Industry Association) 568A Category 5 requirements. The

voice riser cables from the CER to each TC should be sized at a minimum of 30 percent of the total pair distribution planned for the TC, rounded up to the next 100-pair count. Specify 8 pairs (24-gauge) telephone cable in 1-inch conduit.

Data wiring: Copper data wiring shall meet the minimum EIA/TIA Category 5 requirements. Wiring shall be less than 295 feet and terminated in the TC/CER on a RJ45/110 modular patch panel mounted on a hinged wall bracket. All fiber cabling shall meet the minimum ANSI/EIA/TIA-492AAAA requirements. The minimum fiber optic riser cable from the CER to each TC is 6 strands.

Telephone/Data Outlets: Outlets for voice and data shall be dual, RJ-45 with the telephone outlet on top, and the LAN outlet on the bottom. The LAN outlet shall be identified with green marking. RJ-45 outlets shall be no closer than 18 inches to electrical receptacles.

Telecommunications and coax systems shall have surge suppression as appropriate to the degree of mission essentiality.

## **CORROSION CONTROL**

### **GENERAL STANDARDS**

When metal is in contact with water, either above or below ground sacrificial anodes and impressed current systems shall be used; provide test stations and all rectifiers shall be standardized.

# COMPUTER AIDED DESIGN & DRAFTING (CADD) STANDARDS

## GENERAL STANDARDS

**Software:** Drawings submitted as part of a design or final record drawings shall be in AutoCAD Release 12, 13 or 14 formats.

**Media:** Drawings may be submitted on 3.5-inch floppy disks, 100 MB Zip Disks, or CD-ROM.

**Standard Sheets:** D-size (24-inch by 36-inch) sheets are base standard. Both the base map/title sheet and Davis - Monthan border sheet are available on disk. Contact the Engineering Assistant Section at (520) 228-5506 or the Project Engineer/Architect.

## PRODUCTION STANDARDS

**Scale:** Drawings should be produced at full size (1 inch = 1 inch) and scaled to the appropriate size when plotted. Unscaled detail and schedule sheets should be drawn to be plotted at 1=1.

**Pens:** Line colors shall be used for pen sizes. Following are base standards for colors and pen sizes:

No	Color	Pen Size	Width (Inches)
1	Red	1	0.002
2	Yellow	1	0.002
3	Green	1	0.002
4	Cyan	1	0.002
5	Blue	1	0.002
6	Magenta	1	0.002
7	White	1	0.002
8	Dark Gray	3	0.016
9	Red	5	0.020
10	Brown	7	0.023
11	Green	9	0.026
12	Blue	12	0.029
13	Dark Blue	13	0.031
14	Purple	14	0.034
15	Light Gray	15	0.041

\*In lieu of using these sizes, the A-E may elect to use other colors/pen sizes. The A-E's schedule of colors/

pen sizes must be provided in the final submittal.

**Layers:** Use the layers shown in the following list, and additional layers as desired, to help make drawings easier to work with.

Layer Name	Contents
DIM	All dimensions
ROOMS	Room names/no.
TEXT	All remaining text
FLOOR PLAN	The basic background without text, dimensions, detail references.
CEILING	Reflected ceiling grid
EXIST	Any existing items (for renovation projects)

**Lettering:** Lettering shall be sized so the finished drawing has 1/8-inch high general text and 1/4-inch high text for titles. If the drawing has large amounts of text, general text size may be reduced to 3/32-inch with approval of the Project Engineer/Architect. Lettering must still be readable if sheets are half-sized. ROMANS font, color 8 (Dark Gray) shall be used for general text and ROMANS, color 9 (red) shall be used for titles.

**File nomenclature:** Drawings shall be stored under file names consisting of the FBNV number followed by a letter or letters. This letter or letters shall reflect the sequence of sheets in the project beginning with A through Z and then extending to AA, AB, AC, etc. An example of file names for project FBNV 901032 follows:

901032ADWG	First Sheet
901032BDWG	Second Sheet
901032CDWG	Third Sheet
...	
901032AADWG	27 <sup>th</sup> Sheet
901032ABDWG	28 <sup>th</sup> Sheet

Maximum use should be made of "screened" lines to show backgrounds and existing objects.

All drawing files must be provided, including all "xref" drawings, blocks, and any menus or fonts not included in the basic AutoCAD package.

Final submittals must include one complete set of high quality, 3-mil, reproducible mylar drawings. Mylar shall be plotted reverse read, mirror image. Sepia mylars (copies) will not be accepted.

The final submittal shall include as-built drawings on disk

## ADMINISTRATIVE STANDARDS

**Software, Font and Pitch Standards** shall be followed.

For all required documentation - Investigation Report, Design Analysis, Contract Specifications, Color Boards, Bid Schedule, and any other special requirements for the specific project - provide disk and hard copy submittals in MS Word, Version 6.0, using Font Arial, Font Style Regular and Font Size 12.

AF Form 3052, Construction Cost Estimate Breakdown (Computer Generated). Using the example provided on disk, provide disk and hard-copy submittals of the Preliminary

and Construction Cost Estimates in MS Excel, Version 5.0, using, in general, Font MS SansSerif, Font Style Bold and Font Size 10. Note that the Font Sizes may be changed in order to fit entries into specific blocks.

AF Form 66, Schedule of Material Submittals (Computer Generated).

Using the example provided on disk, provide disk and hard copy submittals of the AF Form 66, Schedule of Material Submittals, in MS Excel, Version 5.0, using Font MS Sans Serif, Font Style Bold and Font Size 10. Note that the Font Size may be changed in order to fit entries into specific blocks.







**APPENDIX A  
ZONING MAP**

- Zone 1: Mission*
- Zone 2: Mission Support*
- Zone 3: Family Housing*
- Zone 4: AMARC Zone*



**APPENDIX B  
PRIMARY AND SECONDARY  
STREETS**

Primary Streets: -----  
Secondary Streets: —————



## ADDENDUM NO. 1

dated

31 Jan 2000

to

### Design Compatibility Standards

This addendum shall be incorporated in its entirety into the existing Davis-Monthan Air Force Base Design Compatibility Standards (DCS). Questions concerning this addendum may be directed in writing to the base Architect, 355 CES/CECN, 5220 E. Madera St., Davis-Monthan AFB, AZ 85707-4926.

**Section EXECUTIVE SUMMARY:** Second column, 2<sup>nd</sup> paragraph, 2<sup>nd</sup> sentence, revise to read: In addition, all designs must meet the requirements of the Uniform Building Code (UBC), the Uniform Plumbing Code (UPC), the Uniform Mechanical Code (UMC), the Americans with Disabilities Act Accessibility Guidelines (ADAAG), the Uniform Federal Accessibility Standards (UFAS), the Air Combat Command (ACC) Architectural and Interior Design Standards, and Technical Instruction (TI) 809-04/Air Force Manual (AFMAN) 32-1149 V1 (I), Seismic Design for Buildings, latest versions with all amendments.

**Page 14, section STREETS/PAVING, GENERAL STANDARDS:** First column, 2<sup>nd</sup> paragraph, revise to read: Visual sight distances shall be established at intersections and parking lot entries, and approved by the base Civil Engineering Design Section. Approvals must be obtained through the Project Manager from the base Civil Engineering Design Section. In addition, landscaping and structures at intersections and parking lot entries shall comply with the following minimum standards. Within 50 feet of intersections and parking lot entries, landscaping, site walls and fences, exterior signs (other than traffic control signage), and other vertically-constructed structures shall be limited to no more than 3 feet in height to ensure a minimum of 100 feet of unobstructed views of traffic. No landscaping, site walls and fences, exterior signs, or other structures that may obstruct views shall occur within 20 feet of intersections or parking lot entries. Refer to Department of Defense standards for exact requirements.

**Page 14, section STREETS/PAVING, GENERAL STANDARDS:** Second column, add separate paragraph: Trenching and excavation for utility installations is prohibited except in those instances where boring or jacking cannot be employed. Specify trenchless boring or jacking for utility installations crossing streets or short areas of pavements, sidewalks, and curbs or gutters. When trenching and excavation for utility installations is employed to cross streets or short areas of pavements, comply with the base standard utility patch. Include extra sleeves, capped and marked for ease of identification, for possible future utility crossings.

**Page 21, section LANDSCAPE PLANNING, GENERAL STANDARDS:** Third column, 5<sup>th</sup> paragraph, revise 1<sup>st</sup> sentence to read: Basewide, landscaping should be considered in conjunction with site walls for visual screening of mechanical enclosures and yards, dumpster enclosures, loading docks, etc.; however, landscaping shall not be placed in such a manner as to cause present or future conflicts with periodic maintenance and repair activities.

**Page 29, section HEIGHT/MASSING, GENERAL STANDARDS:** Third column, 2<sup>nd</sup> paragraph, revise to read: Entrances to new and renovated facilities shall be designed to provide a sense of arrival and a clear understanding of the main entrance through measures including but not limited to an easily-identifiable location, orientation, scale or the use of unique architectural features.

**Page 29, section HEIGHT/MASSING, GENERAL STANDARDS:** Third column, add separate paragraph: For *Zone 3*, comply with the Air Force Family Housing Guide for Planning, Programming, Design, and Construction, as well as AFI 32-6002.

**Page 31, section ROOFS, GENERAL STANDARDS:** Second column, 2<sup>nd</sup> paragraph, after the first sentence, add: Generally, this applies to but is not limited to facilities such as base exchanges, commissaries, and warehouses.

**Page 31, section ROOFS, GENERAL STANDARDS:** Second column, 2<sup>nd</sup> paragraph, 3<sup>rd</sup> sentence, revise to read: “Flat” roofs, if used, may be either a standard multi-ply, built-up roofing system or an approved, alternative roofing system such as EPDM. Approval to use alternative roofing systems must be obtained through the Project Manager from the Base Architect.

**Page 31, section ROOFS, GENERAL STANDARDS:** Second column, 3<sup>rd</sup> paragraph, last sentence, revise to read: Approval to use low slope—that is, less than 3:12—and flat roof systems must be obtained through the Project Manager from the Base Architect and the ACC Command Architect.

**Page 32, section ROOFS, GENERAL STANDARDS:** Second column, add separate paragraph: Roof systems shall be the product of one manufacturer. Manufacturer’s systems shall provide 20-year warranted systems.

**Page 37, section SITE WALLS AND FENCES, GENERAL STANDARDS:** Second column, 5<sup>th</sup> paragraph, add before last sentence: Dumpster enclosures for facilities on the flight line shall be located on the base side of the flight line fence. Special consideration shall be given to personnel access from the flight line side of the fence.

**Page 39, section ADDITIONS, METAL BUILDINGS AND TEMPORARY STRUCTURES METAL BUILDINGS:** Third column, 2<sup>nd</sup> paragraph, revise to read: All-metal buildings require ACC approval, regardless of location.

**Page 39, section ADDITIONS, METAL BUILDINGS AND TEMPORARY STRUCTURES METAL BUILDINGS:** Third column, 3<sup>rd</sup> paragraph, revise to read: Use factory-applied finishes with 20 year (or longer) warranties.

**Page 40, section ADDITIONS, METAL BUILDINGS AND TEMPORARY STRUCTURES TEMPORARY BUILDINGS:** Second column, 1<sup>st</sup> paragraph, 1<sup>st</sup> bullet, revise to read: Construction Types used for temporary buildings shall be as defined in the latest edition of the Uniform Building Code.

**Page 40, section ADDITIONS, METAL BUILDINGS AND TEMPORARY STRUCTURES TEMPORARY BUILDINGS:** Second column, 1<sup>st</sup> paragraph, 2<sup>nd</sup> bullet, revise to read: Exterior skirts or walls shall be finished with metal paneling consistent with the architectural character,

form and colors of adjacent facilities; and in compliance with the applicable provisions of these standards.

**Page 40, section ADDITIONS, METAL BUILDINGS AND TEMPORARY STRUCTURES**  
**TEMPORARY BUILDINGS:** Second column, add separate paragraph: Temporary wooden structures for use as sheds and shelters, such as those manufactured under the trade name of Tuff sheds, may not be used on Davis-Monthan.

**Page 48, section ACC INTERIOR DESIGN STANDARDS SYNOPSIS, NON-PERMANENT FINISHES:** Third column, 1<sup>st</sup> paragraph, 1<sup>st</sup> sentence, revise to read: *While non-permanent finishes are allowed in various colors, in office and other work areas, vinyl wall-covering or other painted wall surfaces shall be in a neutral coloration.*

**Page 51, section FINISHES AND INTERIOR TREATMENTS, DOORS AND WINDOWS, Door Hardware:** Second column, after 1<sup>st</sup> paragraph, add separate paragraph: Door lock and padlock cylinders shall have key removable-type cores as manufactured by Best Lock Corporation. Door lock and padlock cylinders shall have 7 pins with “Q” keying. Disassembly of knob or lockset shall not be required to remove core. Keying codes will be provided by the Government to Best Lock Corporation thirty days before beneficial occupancy. It shall be the responsibility of the Contractor to make arrangements with Best Lock Corporation to provide cores and to notify the Contracting Officer when the keying codes should be provided to the manufacturer. For security reasons, no other manufacturer or individual will be provided with these codes. Contractor shall provide interchangeable construction cores to secure the facility during construction. Properly keyed cores shall be provided to the Government at Beneficial Occupancy. Each core shall be provided with two keys stamped “US GOVERNMENT DO NOT DUPLICATE.” The Government will install the cores and return the construction cores to the Contractor.

**Page 51, section FINISHES AND INTERIOR TREATMENTS, DOORS AND WINDOWS, Door Hardware:** Third column, add separate paragraph: Appropriate fire-rated hardware, including panic hardware, shall be used on all fire-rated doors.

**Page 55, section MECHANICAL DESIGN, GENERAL STANDARDS:** First column, 1<sup>st</sup> paragraph, revise to read: In new buildings or buildings undergoing major renovation, an appropriate, well-lighted mechanical room, or rooms, will be provided. Where necessary, mechanical rooms shall be provided with double doors to facilitate removal/replacement actions of equipment and items too large to be easily moved through single doors. Chillers and boilers may be installed in exterior walled or screened mechanical yards or enclosures; maintain compliance with other provisions of these standards. For maintenance access, an engineered, concrete access drive shall be provided to all mechanical rooms, yards and enclosures from the nearest street or parking lot. For facilities undergoing major renovations, especially roofing renovations or repairs, relocate existing roof-mounted mechanical equipment to be ground-mounted to the greatest extent possible.

**Page 55, section MECHANICAL DESIGN, GENERAL STANDARDS:** Second column, 4<sup>th</sup> paragraph, revise to read: Provide hose bibbs in all mechanical rooms, yards and enclosures for maintenance personnel.

**Page 55, section MECHANICAL DESIGN, GENERAL STANDARDS:** Second column, 5<sup>th</sup> paragraph, revise to read: Provide 120/220-volt convenience outlets in all mechanical rooms, yards and enclosures for maintenance personnel. In addition, provide switchable lighting inside



all mechanical rooms, yards and enclosures for maintenance personnel.

**Page 57, section MECHANICAL DESIGN, MECHANICAL SPECIFICATIONS, *Temperature Controls and Energy Management*:** First column, 1<sup>st</sup> paragraph, 4<sup>th</sup> sentence, revise to read: Standard control diagrams and specifications may be provided to the A-E by the Project Manager on an as-needed basis.

**Page 57, section MECHANICAL DESIGN, MECHANICAL SPECIFICATIONS, *Temperature Controls and Energy Management*:** Second column, add separate paragraph: All DDC components shall be provided in a control panel remotely installed from the equipment being controlled. No relays shall be allowed on the equipment. Only control wiring shall be installed on the equipment requiring DDC management.

**Page 57, section MECHANICAL DESIGN, MECHANICAL SPECIFICATIONS, *Miscellaneous*:** Second column, 3<sup>rd</sup> paragraph, add sentence: Air filters shall be placed either at the air handler or in the mechanical room. They shall not be placed in ductwork in interior hallways and rooms.

**Page 57, section MECHANICAL DESIGN, MECHANICAL SPECIFICATIONS, *Miscellaneous*:** Third column, after 2<sup>nd</sup> paragraph, add separate paragraph: All mechanical piping shall be designed with the use of unions, flanges or other means of disconnection to allow for maintenance, repair and replacement activities of pumps, valves, and other equipment.

**Page 58, section HEATING, VENTILATION AND AIR CONDITIONING, GENERAL STANDARDS, GENERAL REQUIREMENTS AND ENERGY CONSERVATION:** First column, 3<sup>rd</sup> paragraph, 1<sup>st</sup> sentence, revise to read: Seasonal Energy Efficiency Ratings (SEER) for air conditioners 5 tons and below shall be at least 12; units larger than 5 tons shall have an EER rating of at least 9.

**Page 60, section HEATING, VENTILATION AND AIR CONDITIONING, GENERAL STANDARDS, COOLING:** Second column, add separate paragraph: Duct cleaning shall be performed on air handling systems and ductwork when project activities affect any portion of the existing air handling systems and ductwork.

**Page 62, section PLUMBING, UNDERGROUND PLUMBING, GENERAL:** First column, 2<sup>nd</sup> paragraph, revise to read: Meter all utilities on new facilities and those undergoing major renovation.

**Page 62, section PLUMBING, UNDERGROUND PLUMBING, GENERAL:** First column, add separate paragraph: All underground non-metallic piping shall be provided with bright-colored, continuously-printed, plastic ribbon tape manufactured for direct burial service. Tape shall be acid- and alkali-resistant, polyethylene film, 6-inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral, magnetically-detectable wire conductors and foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be the industry standard for the specific utility (i.e., blue for water, green for waste, orange for telecommunications, red for electric, and yellow for gas) and bear a continuous printed inscription describing the specific utility.

**Page 62, section PLUMBING, UNDERGROUND PLUMBING, NATURAL GAS:** Third column, after 3<sup>rd</sup> paragraph, add separate paragraph: In addition to the required plastic ribbon tape, an insulated, #12 AWG, solid tracer wire shall be installed along the top of all new underground gas piping.

**Page 63, section PLUMBING, UNDERGROUND PLUMBING, NATURAL GAS:** First column, delete 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> paragraphs.

**Page 63, section PLUMBING, PLUMBING FIXTURES, GENERAL:** Second column, 1<sup>st</sup> paragraph, revise second sentence to read: All techniques shall be considered for both new facilities and facilities undergoing major renovations, including but not limited to: 1 GPM flow restrictors for faucets; 3 GPM low-flow shower heads; single-control mixing type faucets; low-volume flush water closets, 3 gallons or less; self-closing faucet valves; and both battery-powered and hard-wired electronic controls and sensors; however, air-energized flush systems for water closets and urinals shall not be used.

**Page 65, section ELECTRICAL DESIGN, GENERAL STANDARDS:** Second column, 1<sup>st</sup> paragraph, revise to read: For new electric service, 480/277V or 208/120V, 3-phase (Ø) service is preferred.

**Page 65, section ELECTRICAL DESIGN, GENERAL STANDARDS:** Second column, 4<sup>th</sup> paragraph, revise to read: All new facility projects shall include RF-readable, LCD-style, KWH meters for measuring energy consumption and which shall be capable of connection to the EMCS system. New meters shall be the standard manufacture of iTRON or equal. All major renovation projects shall retrofit existing meters with an RF-readable module, iTron or equal. Meter testing and approval required prior to building/facility final acceptance.

**Page 65, section ELECTRICAL DESIGN, GENERAL STANDARDS, Duplex Receptacles:** Third column, 3<sup>rd</sup> paragraph, add last sentence: Install Arc-Fault Circuit Interrupter Protection on all receptacle outlets in housing/dorm dwelling unit bedrooms.

**Page 65, section ELECTRICAL DESIGN, GENERAL STANDARDS:** Third column, 4<sup>th</sup> paragraph, correct National Electrical Safety Code to National Electrical Code.

**Page 66, section ELECTRICAL DESIGN, ABOVEGROUND ELECTRICAL:** Second and third columns, move the 7<sup>th</sup> through 13<sup>th</sup> paragraphs to page 65, at the end of section ELECTRICAL DESIGN, GENERAL STANDARDS.

**Page 66, section ELECTRICAL DESIGN, ABOVEGROUND ELECTRICAL:** Third column, 2<sup>nd</sup> paragraph, delete the 2<sup>nd</sup> sentence. (Note that this paragraph has been moved to page 65, into section ELECTRICAL DESIGN, GENERAL STANDARDS, per previous direction.)

**Page 66, section ELECTRICAL DESIGN, ABOVEGROUND ELECTRICAL:** Third column, combine the 3<sup>rd</sup> paragraph to the end of the 2<sup>nd</sup> paragraph. (Note that this paragraph has been moved to page 65, into section ELECTRICAL DESIGN, GENERAL STANDARDS, per previous direction.)

**Page 66, section ELECTRICAL DESIGN, ABOVEGROUND ELECTRICAL:** Third column, 4<sup>th</sup> paragraph, revise to read: Transformers shall be liquid-filled, copper-wound, PCB-free, pad-mounted, dead-front, loop-feed with lightning protection, dry-well current limiting fuses, group internal high voltage switch, and 2-2 ½ percent taps above and below rated voltage.

Consider “K” factor. (Note that this paragraph has been moved to page 65, into section ELECTRICAL DESIGN, GENERAL STANDARDS, per previous direction.)

**Page 66, section ELECTRICAL DESIGN, ABOVEGROUND ELECTRICAL:** Third column, 5<sup>th</sup> paragraph, revise to read: Panelboards: Provide typewritten panel schedules. Provide manual bypass for all auto transfer generator panels. Provide bolt-on circuit breakers only. (Note that this paragraph has been moved to page 65, into section ELECTRICAL DESIGN, GENERAL STANDARDS, per previous direction.)

**Page 66, section ELECTRICAL DESIGN, ABOVEGROUND ELECTRICAL:** Third column, add separate paragraph: Services: Service conductors and equipment for control and protection of services shall be installed per the NEC. Install main service equipment for the facility inside the mechanical/electrical room.

**Page 67, section ELECTRICAL DESIGN, INTERIOR POWER:** First column, 4<sup>th</sup> paragraph, add last sentence: Use bolt-on circuit breakers.

**Page 67, section ELECTRICAL DESIGN, INTERIOR POWER:** Second column, 2<sup>nd</sup> paragraph, revise to read: Power Service: Power requirements for buildings shall be 208/120V or 480/277V.

**Page 67, section ELECTRICAL DESIGN, INTERIOR POWER:** Third column, 3<sup>rd</sup> paragraph, revise to read: All new buildings are not required to have lightning protection systems designed into the project. Buildings containing high-value, lightning-sensitive assets or explosive materials/munitions shall have lightning protection designed into the project. Coordinate the requirement to install a lightning protection system through the base Project Manager and base Electrical Engineer. For facilities requiring lightning protection, be sure to use adhesive-mounted air terminals and to provide vibroground test point(s).

**Page 67, section ELECTRICAL DESIGN, LIGHTING:** Third column, 1<sup>st</sup> paragraph, revise to read: Provide wire guards for all open fluorescent lamps. Utilize energy-saver, 32-watt, T-8 fluorescent, low mercury “green” lamps and electronic ballasts in administrative and similar areas. Use metal halide in hangar/bay areas, even in areas of non-critical color rendition. Daylighting (Natural Lighting Co., Inc., or equal) shall be used in all hangars/bays/warehouses and similar areas. Use automatic light controller in the design. Provide seismic protection for all fixtures, especially ceiling grid-mounted fluorescent fixtures. Provide Certified Ballast manufacturer (CBM) listed ballasts. All ballasts shall be electronic and shall have 0.90 power factor or greater with a total harmonic distribution of <10%.

**Page 68, section ELECTRICAL DESIGN, LIGHTING:** First column, 4<sup>th</sup> paragraph, add last sentence: Building security lighting shall be on a photocell/timer circuit.

**Page 68, section ELECTRICAL DESIGN, LIGHTING:** Second column, 4<sup>th</sup> paragraph, revise to read: Use LED-style exit lights, with nickel-cadmium type emergency batteries. When renovating facilities with existing incandescent/fluorescent exit signs, retrofit lamps with Merlin (Lithonia Lighting) LED light tubes or equal. When renovating facilities with existing radioluminescent exit signs, the Contractor shall remove and turn the signs over to the Contracting officer for proper disposal through 355 CES/CEO.

**Page 68, section ELECTRICAL DESIGN, LIGHTING:** Second column, 5<sup>th</sup> paragraph, revise to read: All emergency exit lighting shall be on dedicated circuits to facilitate connection or future



connection to the EMCS system. Emergency exit lighting in offices and shops shall be ceiling mounted; no wall packs or bugeyes. If EMCS connection is required for emergency exit lighting, override switches shall be placed in areas around the facility, including individual offices, in locations acceptable to and approved by the base Electrical Engineer.

**Page 69, section FIRE PROTECTION, GENERAL STANDARDS:** First column, 1<sup>st</sup> paragraph, 1<sup>st</sup> sentence, correct REPCO to read MONACO.

**Page 69, section FIRE PROTECTION, GENERAL STANDARDS:** First column, 2<sup>nd</sup> paragraph, revise to read: Design Conditions: All fire protection design shall be per NFPA 13, NFPA 13R, Life Safety Code and Military Handbook 1008C. Design of the fire protection system shall typically be of the performance-type and shall normally be the responsibility of the A-E. In some instances, the A-E may be required to perform the requisite flow tests for incorporation into the design.

**Page 69, section FIRE PROTECTION, GENERAL STANDARDS:** First column, 3<sup>rd</sup> paragraph, 2<sup>nd</sup> sentence, revise to read: Aboveground piping systems shall be Schedule 40 steel with threaded or welded or victaulic connections.

**Page 69, section FIRE PROTECTION, WATER DISTRIBUTION:** First column, after 1<sup>st</sup> paragraph, add new separate paragraph: Fire hydrants shall be the standard manufactured by Clow, Model F2545.

**Page 69, section FIRE PROTECTION, WATER DISTRIBUTION:** First column, 3<sup>rd</sup> paragraph, correct 1008B to 1008C.

**Page 69, section FIRE PROTECTION, FIRE ALARM SYSTEMS:** Second column, 3<sup>rd</sup> paragraph, 1<sup>st</sup> sentence, revise to read: Transponders shall be...designed for compatibility with Monaco radio multiplex system.

**Page 69, section FIRE PROTECTION, FIRE ALARM SYSTEMS:** Second column, 3<sup>rd</sup> paragraph, 3<sup>rd</sup> sentence, revise to read: An exterior, wall-mounted antenna with ground shall be installed for each transponder and shall be one-half dipole with 2.25 dB gain, manufactured by Monaco.

**Page 69, section FIRE PROTECTION, FIRE ALARM SYSTEMS:** Second column, 3<sup>rd</sup> paragraph, add last sentence: Fire alarm panel shall be the standard manufacture of FCI.

**Page 69, section FIRE PROTECTION, FIRE DETECTION SYSTEMS:** Third column, 1<sup>st</sup> paragraph, 2<sup>nd</sup> sentence, revise to read: Temperature classification of heat detectors shall be determined in accordance with NFPA Standard 72, Chapter 5. Generally, use 135-degree Fahrenheit, fixed temperature heat detectors in all areas below ceilings; and 194-degree Fahrenheit, fixed temperature heat detectors above ceilings.

**Page 69, section FIRE PROTECTION, FIRE SUPPRESSION SYSTEMS:** Third column, 1<sup>st</sup> paragraph, add: Specifications shall include the provisions for the Contractor to flow test the existing hydrants adjacent to the site which were used in the design, to confirm the design parameters, prior to providing submittals of the fire suppression water distribution system. The Contractor shall be required to notify the Contracting Officer of any discrepancies both in the submittal and prior to construction. The Contractor shall also be required in the specifications to conduct flow tests of all newly-installed fire hydrants and the existing adjacent upstream and

downstream fire hydrants after completion of construction and prior to final acceptance. All flow tests shall be conducted in the presence of the Contracting Officer or his authorized representative, and a representative of the base Fire Department. Water runoff shall be controlled in a manner satisfactory to the Contracting Officer.

**Page 69, section FIRE PROTECTION, FIRE SUPPRESSION SYSTEMS:** Third column, 2<sup>nd</sup> paragraph, revise to read: Tamper Switches: All OS&Y for fire sprinkler, deluge, and AFFF systems must have tamper switches connected into fire alarm system, on its own zone.

**Pages 73, section COMPUTER AIDED DESIGN & DRAFTING (CADD) STANDARDS, GENERAL STANDARDS:** First column, 3<sup>rd</sup> paragraph, last sentence, correct Project Engineer/Architect to Project Manager.

**Pages 73, section COMPUTER AIDED DESIGN & DRAFTING (CADD) STANDARDS, PRODUCTIONS STANDARDS:** First column, 3<sup>rd</sup> paragraph, revise to read: If additional colors/pen sizes are needed beyond the base-standards shown above, the A-E may schedule other colors/pen sizes. The A-E's schedule of colors/pen sizes shall be provided in the final submittal.

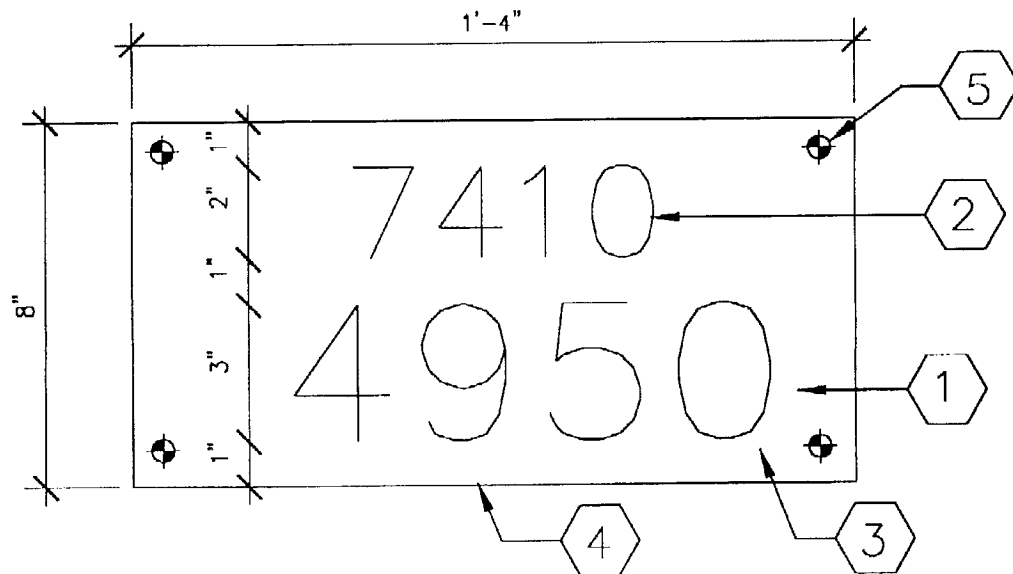
**Pages 73, section COMPUTER AIDED DESIGN & DRAFTING (CADD) STANDARDS, PRODUCTIONS STANDARDS:** Second column, 2<sup>nd</sup> paragraph, 2<sup>nd</sup> sentence, correct Project Engineer/Architect to Project Manager.

**Pages 73, section COMPUTER AIDED DESIGN & DESIGN & DRAFTING (CADD) STANDARDS, PRODUCTIONS STANDARDS:** Third column, 1<sup>st</sup> paragraph, add: Colors 250-255 shall be used for screened lines. Color 250 should be screened at approximately 90% with each successive pen reducing intensity by 10% to color 255.

**Pages 73, section COMPUTER AIDED DESIGN & DESIGN & DRAFTING (CADD) STANDARDS, PRODUCTIONS STANDARDS:** Third column, delete the 4<sup>th</sup> paragraph.

**Pages 73-74, section COMPUTER AIDED DESIGN & DRAFTING (CADD) STANDARDS, ADMINISTRATIVE STANDARDS:** Third column, revise 2<sup>nd</sup> and 3<sup>rd</sup> paragraphs to read: In order to be ready for publication on the Internet, the Investigation Report, Design Analysis, and Contract Specifications shall be provided in Adobe Acrobat format. For ease of viewing, the Tables of Contents for each document shall be linked to each individual section. For all other required documentation, see the project Statement of Work.

END OF ADDENDUM



#### KEYNOTES

1. 3" REFLECTIVE WHITE VINYL LETTERS  
(BUILDING ADDRESS, EXAMPLE ONLY)
2. 2" REFLECTIVE WHITE VINYL LETTERS  
(BUILDING NUMBER, EXAMPLE ONLY)
3. BACKGROUND SCOTCH LITE "BROWN"
4. 18 GA. SHT. METAL PANEL
5. SIGNAGE ATTACHMENT LOCATION

COORDINATE BUILDING ADDRESS AND NUMBER, AND MOUNTING  
LOCATIONS WITH CONTRACTING OFFICER PRIOR TO FABRICATION.  
(2 REQ'D PER FACILITY)

## BUILDING ADDRESS SIGN

NTS

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	BUILDING ADDRESS SIGN	CHECKED BY	MO INGALLS	DETAIL NO DM-A 001
		SCALE	NONE	
		DATE	25 FEB 99	



# CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR				ADDRESS					
ONLY 3 BLANKS GET FILLED IN ON TOP BLOCK--TOP BLOCK SAME FOR EACH PAGE									
CONTRACT FOR(WORK TO BE PERFORMED)				(PUT PROJECT NAME HERE)				PROPOSED TOTAL CONTRACT PRICE	
PURCHASE REQUEST NUMBER				PROJECT NUMBER		(PUT PROJECT NUMBER HERE)		WORK LOCATION	
								DAVIS-MONTHAN AFB, AZ 85707	

LINE NO.	ITEM	UNIT OF MEASURE	QUANTITY	MATERIAL COST		LABOR COST			DIRECT COSTS	LINE TOTAL
				UNIT	TOTAL	MANHOURS	RATE	TOTAL		

## SUMMARY

FIRST SHEET OF ESTIMATE SHOULD BE SUMMARY SHEET WITH OH&P AND SIGNATURE

1	SUBTOTAL CIVIL WORK				17,988				17,124	820	35,932
2	SUBTOTAL ARCHITECTURAL				58,741				60,147	8,710	127,598
3	SUBTOTAL MECHANICAL				12,587				15,478	2,479	30,544
4	SUBTOTAL ELECTRICAL				19,547				16,587	2,540	38,674

## LINE TOTALS

OVERHEAD (15%)

SUBTOTAL

PROFIT (10%)

SUBTOTAL

TAX (5% of 65%)

BID BOND(1.4%)

TOTAL PROJECT PRICE

108,863

109,336 14,549 232,748

LEAVE THESE COLUMNS BLANK ON SUMMARY SHEET

THESE CAN VARY BASED UPON PROJECT & BIDDING CLIMATE -- COORDINATE WITH PROJECT MANAGER

DO NOT FORGET TAX -- CALCULATED ON SUBTOTAL

BID BOND FOR PROJECTS > 25K - % VARIES -- CALCULATED ON SUBTOTAL

34,912

267,660

26,766

294,426

9,569

4,122

**\$308,117**

ALL \$ ON THE SUMMARY SHEET SHOULD BE ROUNDED TO THE NEAREST \$

DATE: 14-Feb-95

FIRM NAME: 355 CES/CEEE

PROJECT MANAGER

TITLE: PROJECT ENGINEER

BY:

NUMBER PAGES

BOTTOM OF EVERY PAGE OF ESTIMATE

PROJECT MANAGER

ORIGINAL SIGNATURE OF CEEE PM (NOT A-E) TO CONS/ COC, COORD WITH PROJECT MGR

PAGE 1 OF 2

# CONSTRUCTION COST ESTIMATE BREAKDOWN

CONTRACTOR				ADDRESS						
CONTRACT FOR(WORK TO BE PERFORMED)				ONLY 3 BLANKS GET FILLED IN ON TOP BLOCK--TOP BLOCK SAME FOR EACH PAGE				PROPOSED TOTAL CONTRACT PRICE		
PURCHASE REQUEST NUMBER				PROJECT NUMBER (PUT PROJECT NUMBER HERE)				WORK LOCATION DAVIS-MONTHAN AFB, AZ 85707		
LINE NO.	ITEM	UNIT OF MEASURE	QUANTITY	MATERIAL COST		LABOR COST			DIRECT COSTS	LINE TOTAL
				UNIT	TOTAL	MANHOURS	RATE	TOTAL		

CIVIL WORK ← PUT A TITLE ON EACH SHEET TO CLARIFY WHAT IS BEING ESTIMATED -- SHOULD MATCH SUMMARY SHEET

1	SUBGRADE COMPACTION	LF	2000.0	2.00	4,000	200.0	22.00	4,400	250	8,650
2	ABC	CF	1000.0	2.50	2,500	120.0	22.00	2,640	100	5,240
3	CURB CONCRETE	LF	500.0	15.00	7,500	300.0	22.00	6,600	250	14,350
4	ASPHALTIC CONCRETE, 4" THICK	SF	2000.0	1.90	3,800	142.0	22.00	3,124	120	7,044
5	STRIPING	LF	750.0	0.25	188	20.0	18.00	360	100	648

A	X	B	=	C	D	X	E	=	F	G	C + F + G
---	---	---	---	---	---	---	---	---	---	---	-----------

GENERALLY DESCRIBE ITEM BEING ESTIMATED

ALL CIVIL WORK (OR WHAT EVER TYPE WORK) SHOULD BE NUMBERED CONSECUTIVELY, EVEN IF IT TAKES MORE THAN ONE SHEET

SELECT UNIT OF MEASURE TO MAKE UNIT COST REASONABLE

SUBTOTAL AT BOTTOM OF EVERY SHEET

SUBTOTAL THIS SHEET

SUBTOTAL CIVIL WORK

QUANTITY COLUMN TO NEAREST TENTH

MATERIAL COST TO NEAREST CENT

MANHOURS TO NEAREST TENTH

LABOR RATE TO NEAREST CENT

THE FOUR TOTAL COLUMNS SHOULD BE ROUNDED TO NEAREST DOLLAR

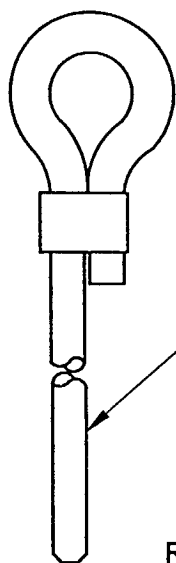
17,988

17,124

820

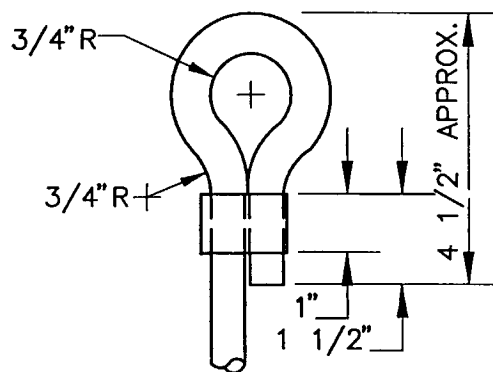
35,932

ON LAST SHEET QUANTITIES SHOULD MATCH THOSE ON SUMMARY SHEET



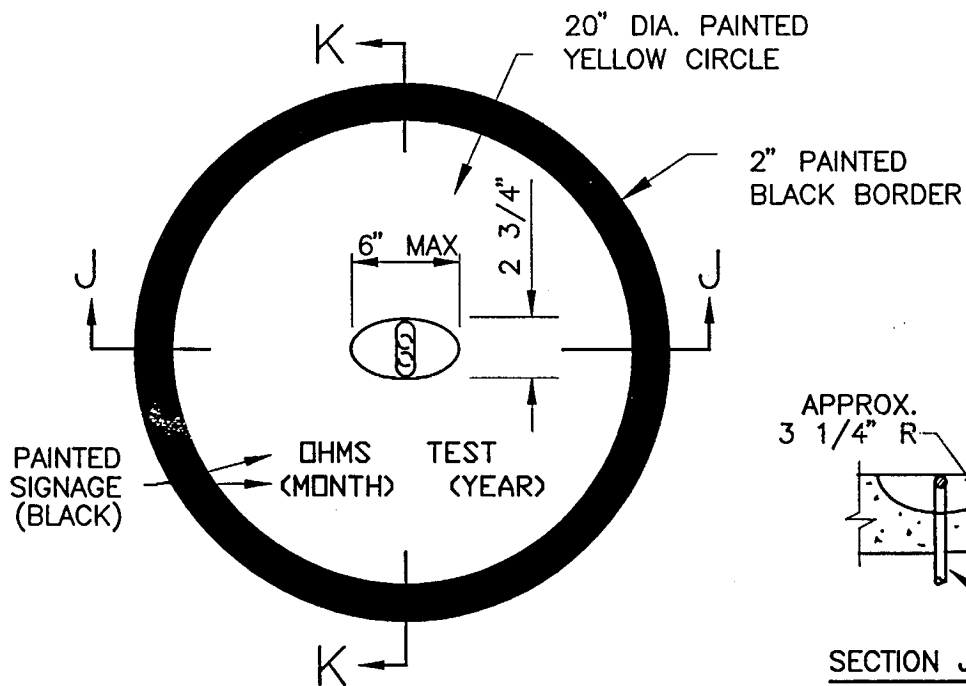
3/4" x 10'-0"  
(COPPERWELD OR EQUAL)

ROD DETAIL

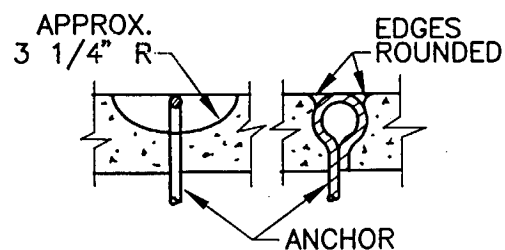


COPPER SLEEVE  
COMPRESSED ON ROD

DETAIL OF EYE AND SLEEVE  
ASSEMBLY



PLAN VIEW



SECTION J-J

SECTION K-K

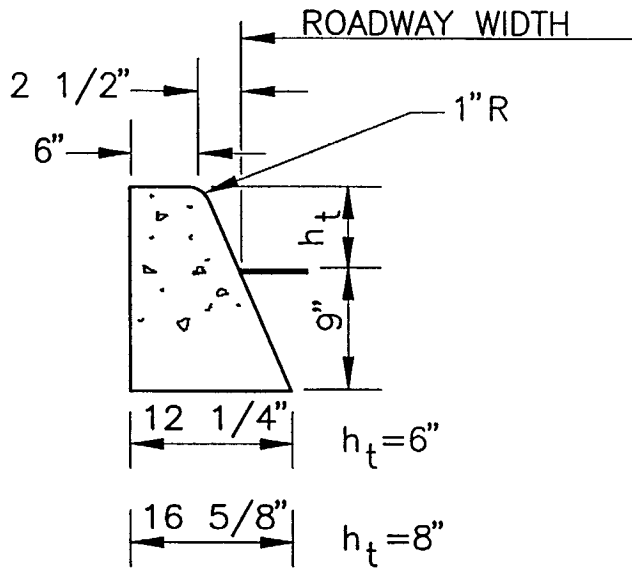
DETAIL OF PAVEMENT

# GROUNDING ROD DETAILS

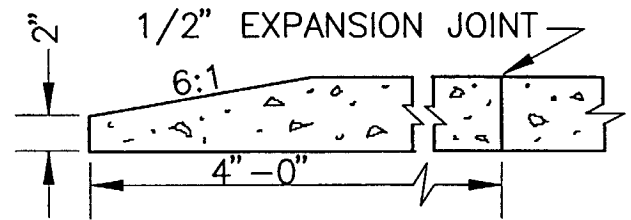
NTS

<p>DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE</p>	<p>GROUNDING ROD DETAILS</p>	<p>CHECKED BY J. BARKER SCALE NONE DATE 15 JUN 95</p>	<p>DETAIL NO DM-C 002</p>
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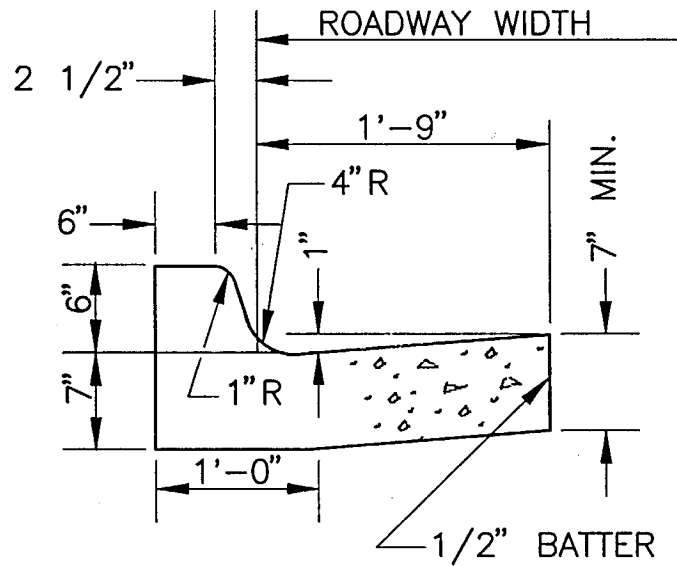




SINGLE CURB



CURB TERMINAL SECTION

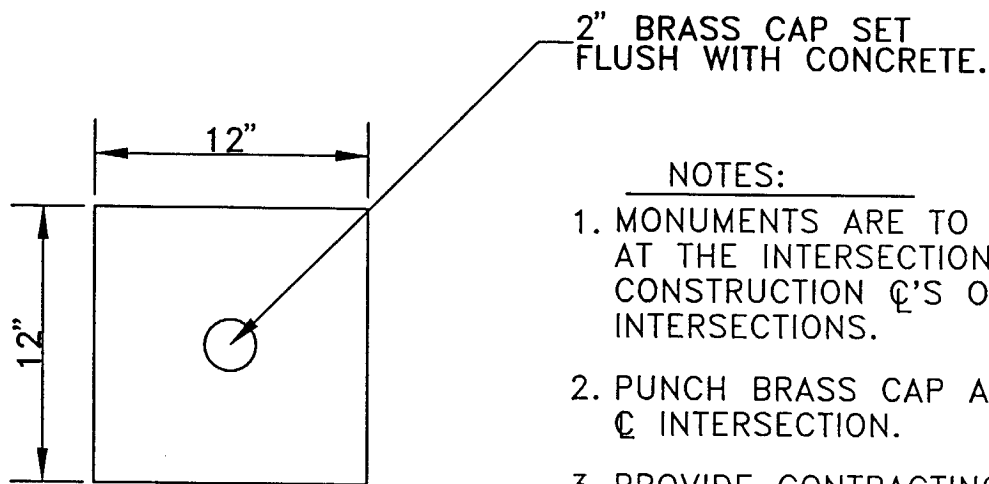


CURB & GUTTER

# CURBING DETAILS

NTS

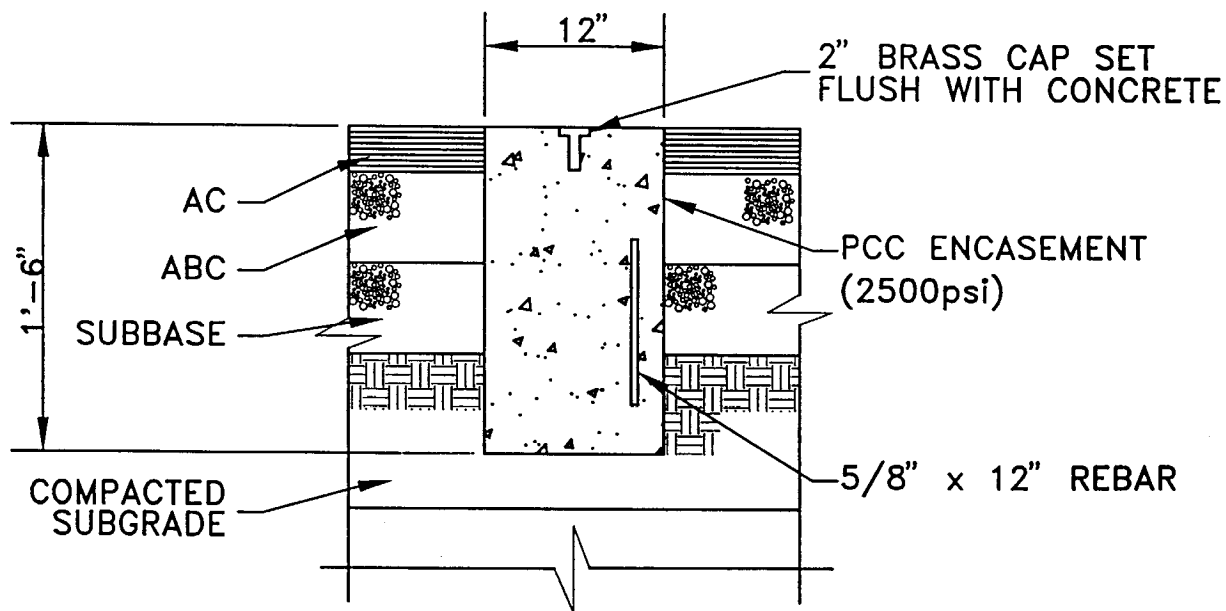
DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	CURBING DETAILS	CHECKED BY J. BARKER	DETAIL NO DM-C 003
		SCALE NONE	
		DATE 15 JUN 95	



TOP VIEW

NOTES:

1. MONUMENTS ARE TO BE PLACED AT THE INTERSECTION OF CONSTRUCTION  $\mathcal{Q}$ 'S OF ALL NEW INTERSECTIONS.
2. PUNCH BRASS CAP AT EXACT  $\mathcal{Q}$  INTERSECTION.
3. PROVIDE CONTRACTING OFFICER WITH LIST OF ALL BRASS CAP ELEVATIONS.

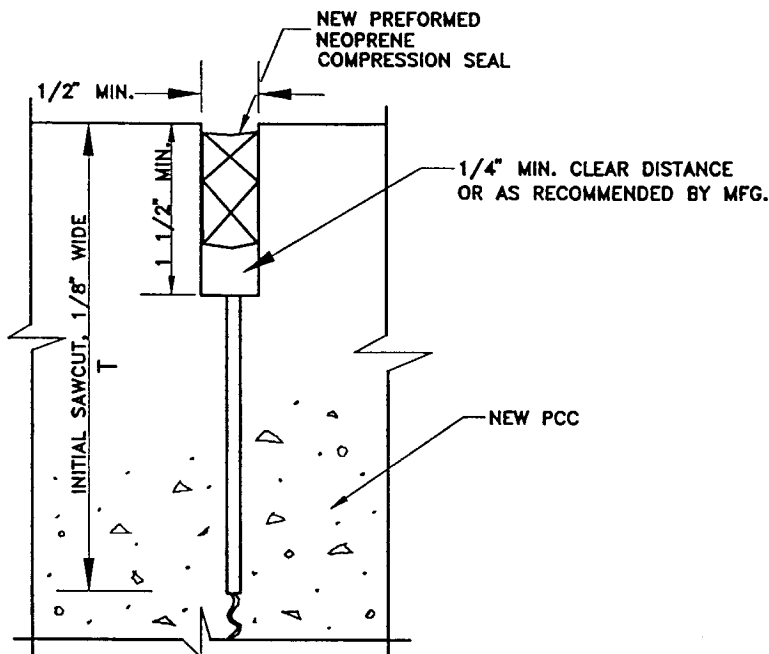


PROFILE

# SURVEY MONUMENT DETAIL

NTS

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	SURVEY MONUMENT DETAIL	CHECKED BY	J. BARKER	DETAIL NO DM-C 004
		SCALE	NONE	
		DATE	15 JUN 95	



**SAWED CONTRACTION JOINT  
WITH PREFORMED SEALS**

**NOTES:**

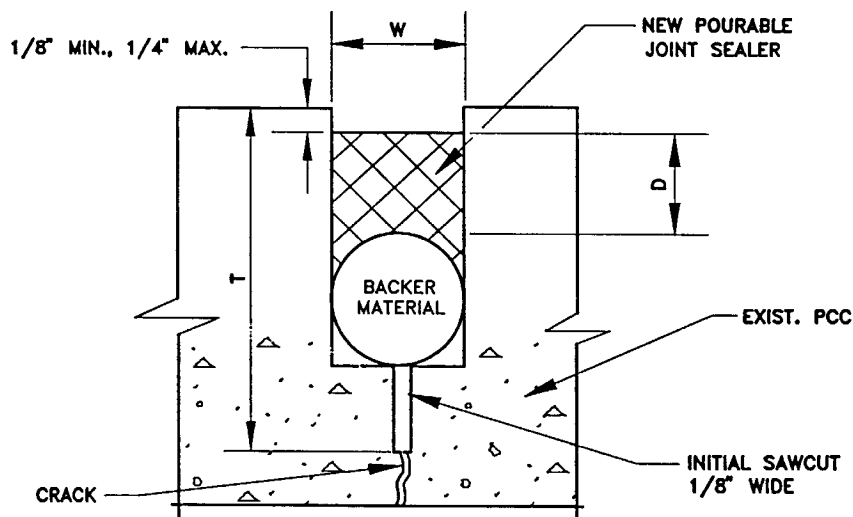
1. DEPTH & WIDTH AS RECOMMENDED BY MANUFACTURER PER TYPE OF SEAL BEING USED.
2. TOP OF PREFORMED SEAL WILL BE  $3/16" + 1/16"$  BELOW PAVEMENT SURFACE.
3. COMPRESSION SEAL MUST BE IN COMPRESSION AT ALL TIMES.
4. WIDTH SHALL NOT BE LESS THAN  $1/2" + 1/8", -0"$ .
5. DIMENSIONS ARE FOR RECEIVING SLOT, NOT THE SEAL.
6. REFER TO TAC DE-103-85, DESIGN OF RIGID AFLD PAVEMENTS, ATTACH. #1 FOR PREFORMED COMPRESSION SEAL.

**TABLE 1**

JOINT SPACING FT.	WIDTH, IN.	
	MIN.	MAX.
< 25	1/2	5/8
25 - 50	3/4	7/8
> 50	1/0	1-1/8

**NOTES:**

1. NONABSORBENT BACKER MATERIAL REQUIRED TO PREVENT SEALANT FROM FLOWING INTO SAWCUT; TO SEPARATE NONCOMPACTABLE MATERIALS AND PREVENT JOINT SEALANTS FROM BONDING TO BOTTOM OF RESERVOIR.



**POURABLE JOINT  
SEALANT RESERVOIR**

W = WIDTH OF SEALANT RESERVOIR (SEE TABLE 1)  
D = DEPTH OF SEALANT (1.0 TO 1.5 x W)  
T = DEPTH OF INITIAL SAWCUT:

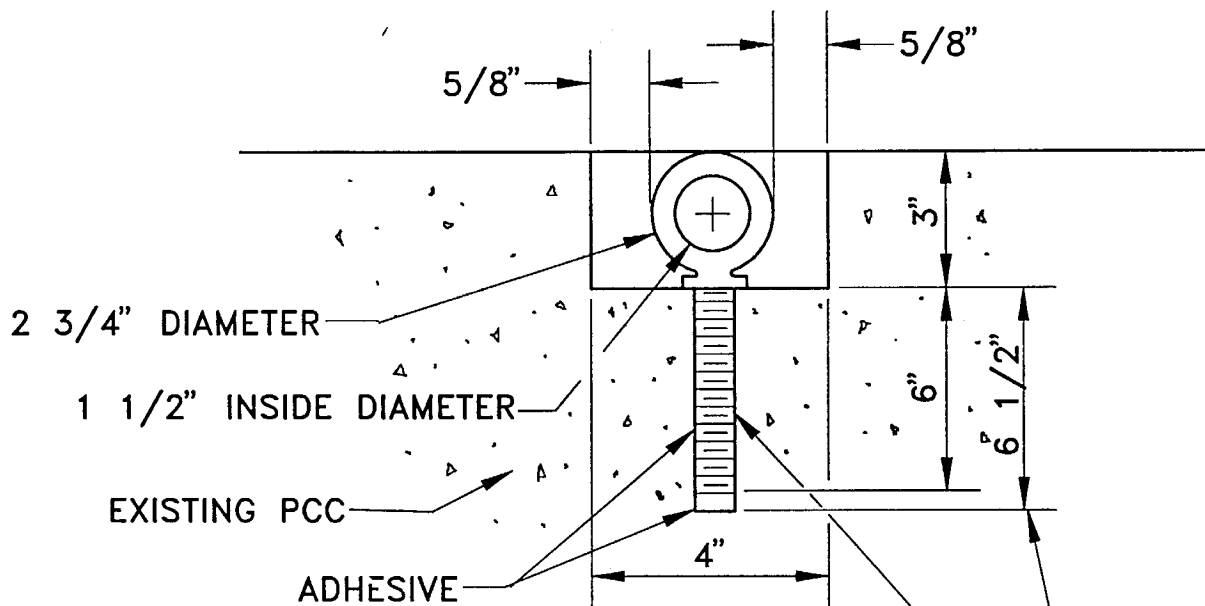
- a. 1/4 SLAB THICKNESS FOR PAVEMENT LESS THAN 12 INCHES
- b. 3 INCHES FOR PAVEMENTS 12-18 INCHES
- c. 1/6 SLAB THICKNESS FOR PAVEMENTS MORE THAN 18 INCHES.

# **CONTRACTION JOINT DETAILS**

NTS

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND <b>DAVIS-MONTHAN AFB, AZ</b> CIVIL ENGINEER OFFICE	<b>CONTRACTION JOINT DETAIL</b>	CHECKED BY	J. BARKER	DETAIL NO <b>DM-C 005</b>
		SCALE	NONE	
		DATE	15 JUN 95	





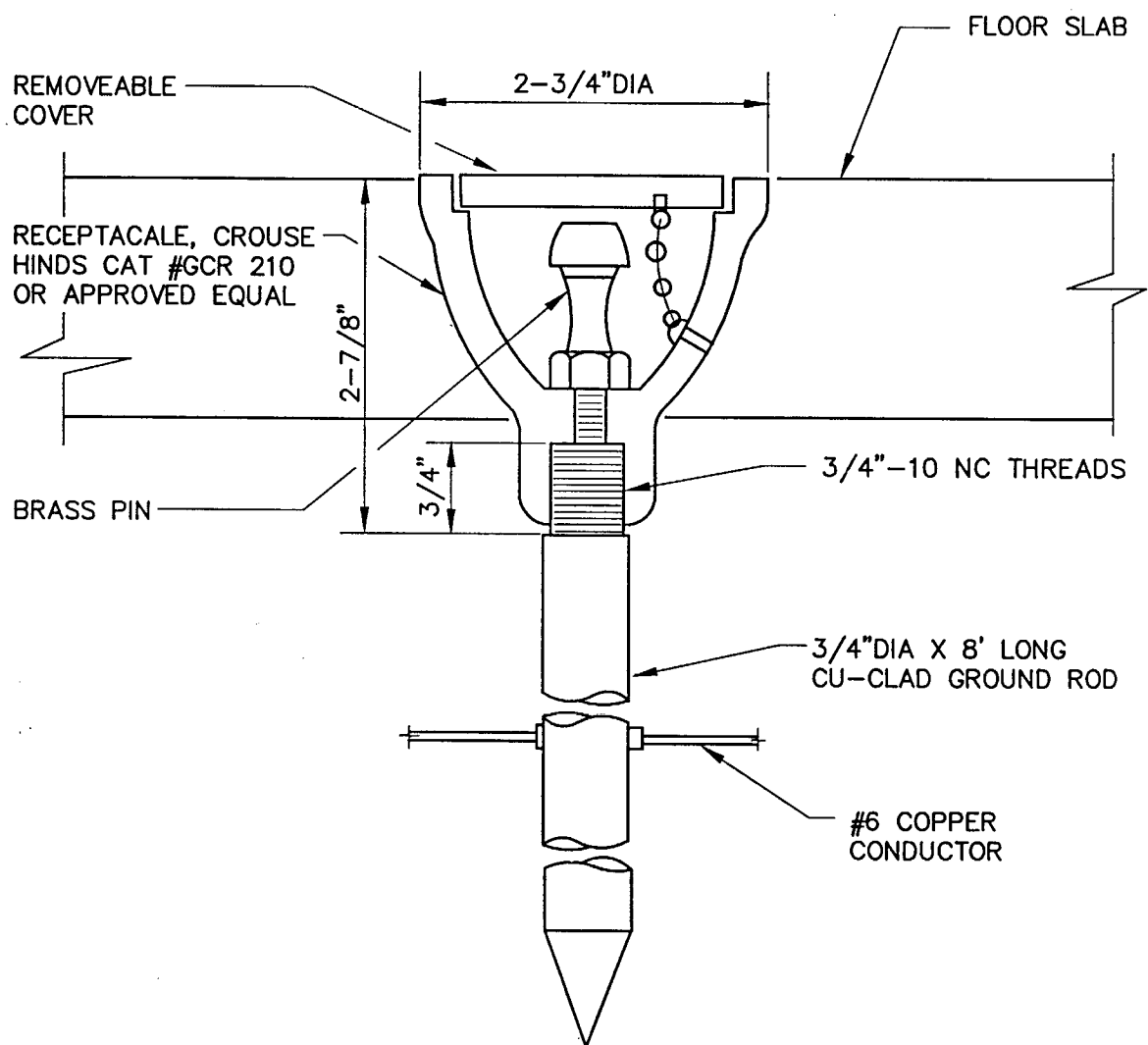
3/4" DIA. DROP FORGED GALVANIZED EYE BOLT  
 WITH SHOULDER. SAFE LOAD OF 5200 LBS.  
 TOP OF EYE BOLT SHALL BE BETWEEN  
 FLUSH AND MINUS 1/8" WITH PCC SURFACE.

OR PER MANUFACTURERS  
 RECOMMENDATIONS IF  
 DIFFERENT

## AIRCRAFT TIE DOWN DETAIL

NTS

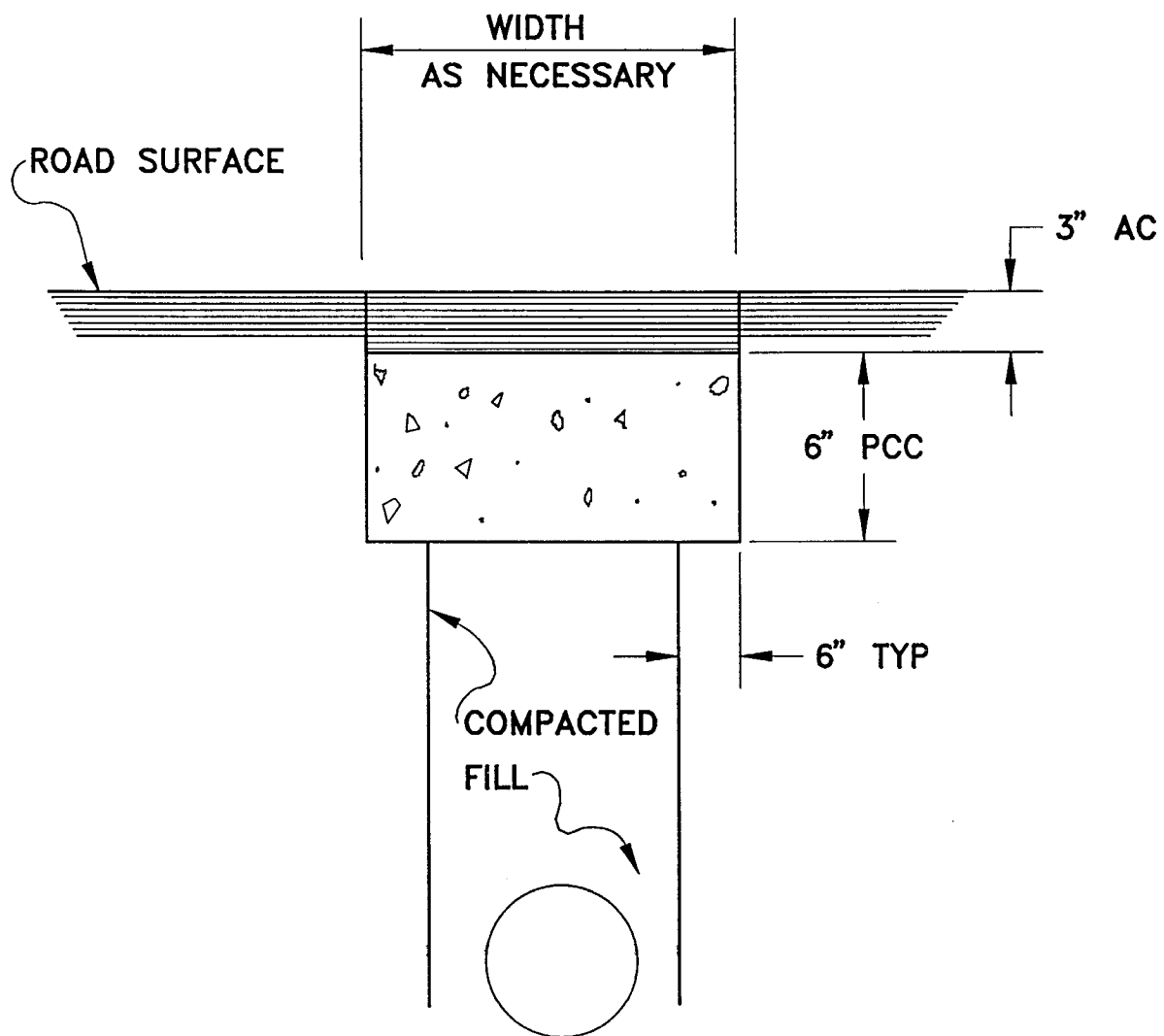
DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND <b>DAVIS-MONTHAN AFB, AZ</b> CIVIL ENGINEER OFFICE	<b>AIRCRAFT TIE DOWN          DETAIL</b>	CHECKED BY J. BARKER SCALE NONE DATE 15 JUN 95	DETAIL NO <b>DM-C          006</b>
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## STATIC GROUNDING RECEPTACLE FOR INDOOR FLOORS

NTS

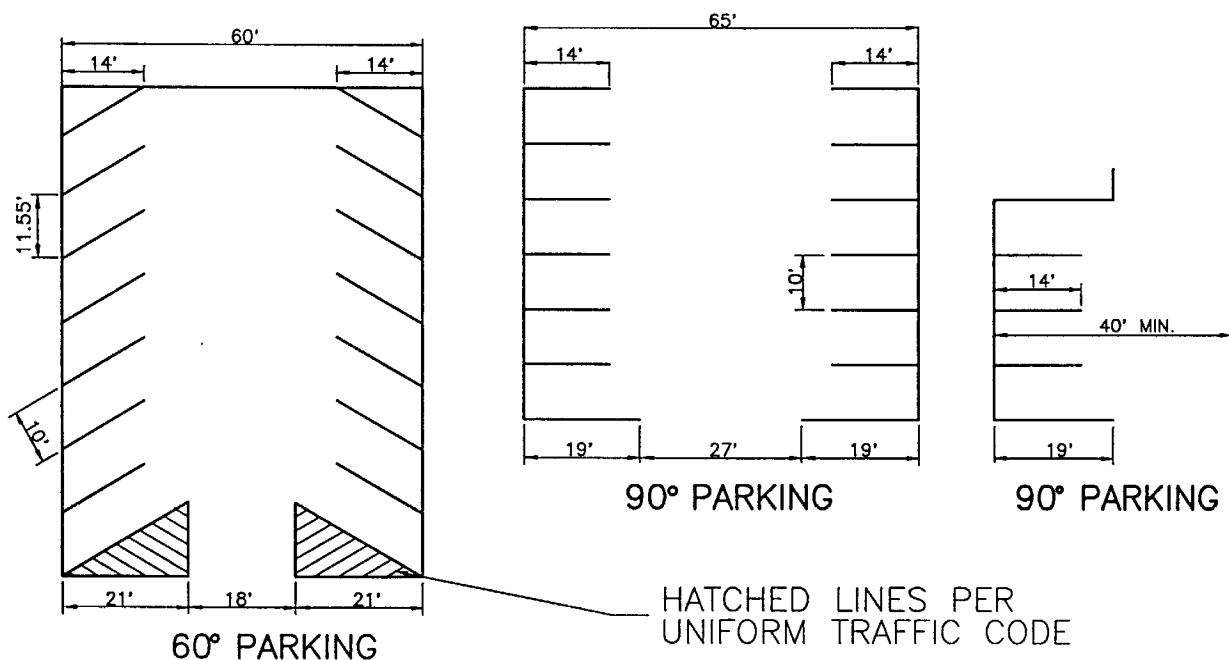
DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	STATIC GROUNDING RECEPTACLE FOR INDOOR FLOORS	CHECKED BY	J. BARKER	DETAIL NO DM-C 007
		SCALE	NONE	
		DATE	15 JUN 95	



# UTILITY PATCH

NTS

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	UTILITY PATCH	CHECKED BY	J. BARKER	DETAIL NO DM-C 008
		SCALE	NONE	
		DATE	15 JUN 95	

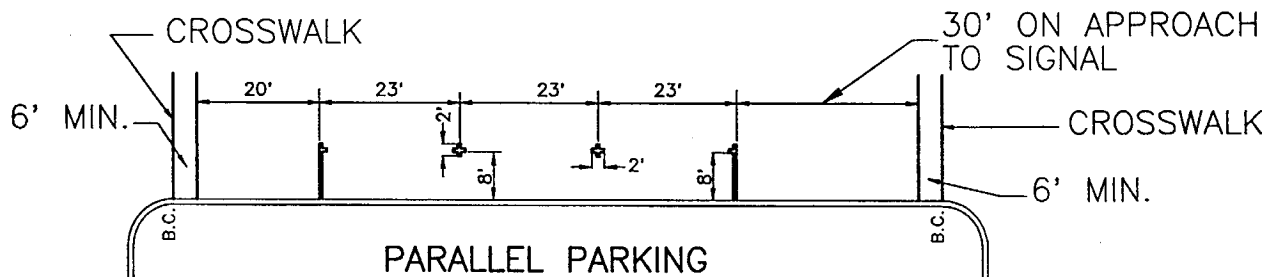


### HANDICAP PARKING DIMENSIONS

ONE VAN.....20' DEEP x 16' WIDE  
 TWO VANS....20' DEEP x 24' WIDE  
 ONE CAR.....20' DEEP x 13' WIDE  
 TWO CARS....20' DEEP x 21' WIDE  
 (REF. UNIFORM FEDERAL ACCESSIBILTIIY STANDARDS)

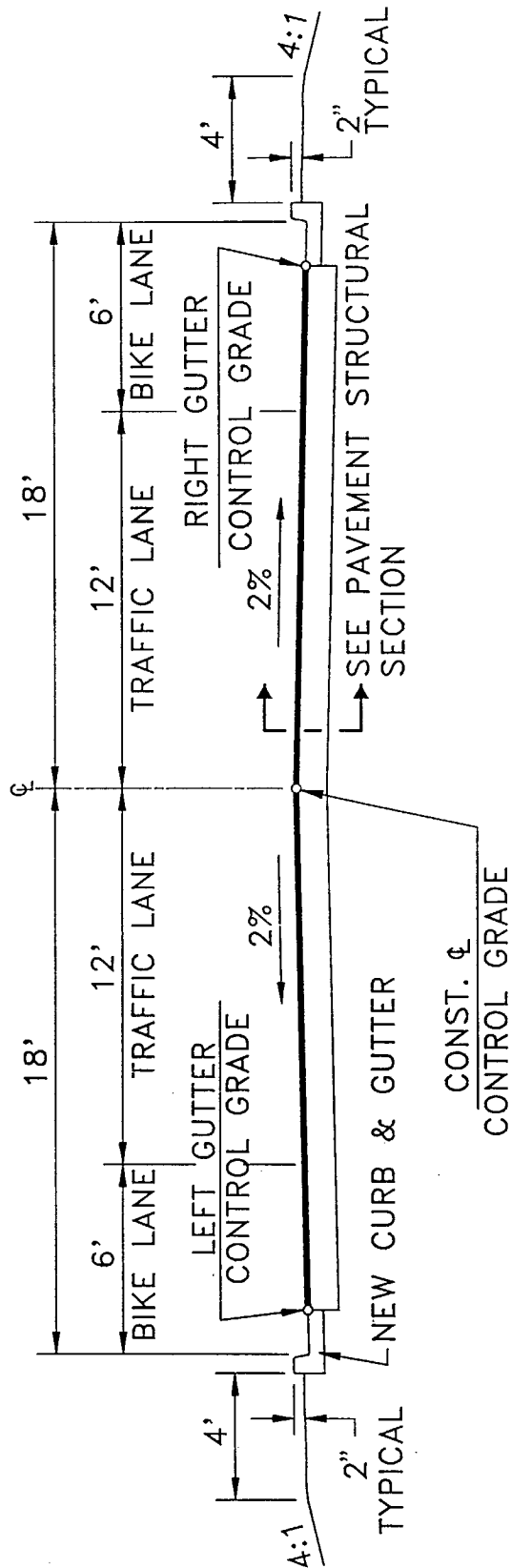
### NOTES:

1. HANDICAP SIGN TO BE USED WHERE APPROPRIATE.
2. ALL PAVEMENT MARKINGS TO BE WHITE IN COLOR.
3. ALL STRIPES WILL BE 4" WIDE.



DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	STANDARD PARKING DETAIL	CHECKED BY J. BARKER SCALE NONE DATE 15 JUN 95	DETAIL NO DM-C 009
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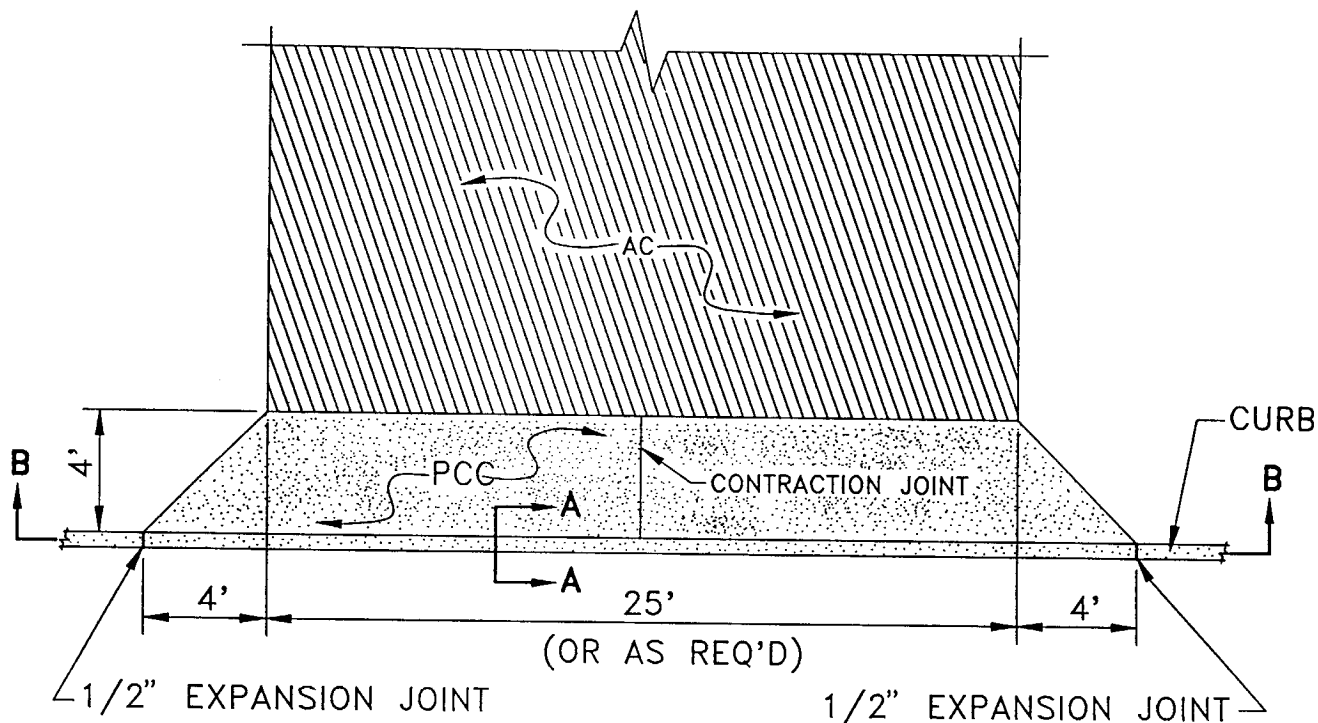




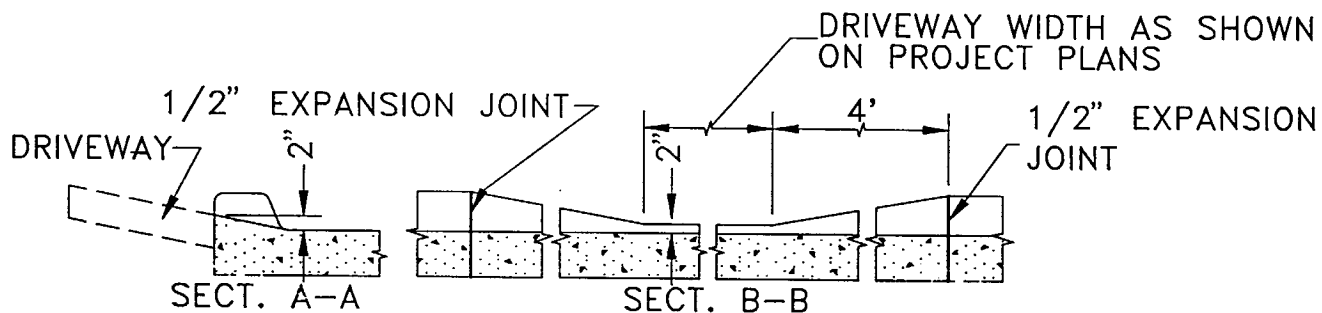
## TYPICAL ROADWAY SECTION

SCALE: 1" = 5'

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND <b>DAVIS-MONTHAN AFB, AZ</b> CIVIL ENGINEER OFFICE	<b>TYPICAL ROADWAY SECTION</b>	CHECKED BY J. BARKER	DETAIL NO <b>DM-C 010</b>
		SCALE NONE	
		DATE 15 JUN 95	



DRIVEWAY  
N.T.S.



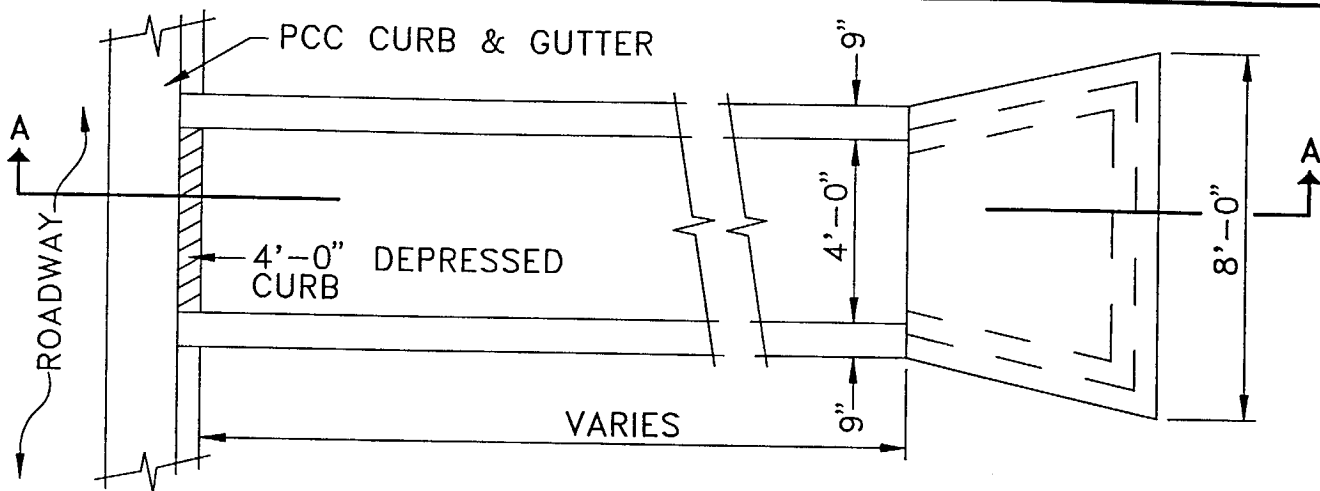
DEPRESSED CURB AT DRIVEWAY ENTRANCE  
N.T.S.

**NOTE:**

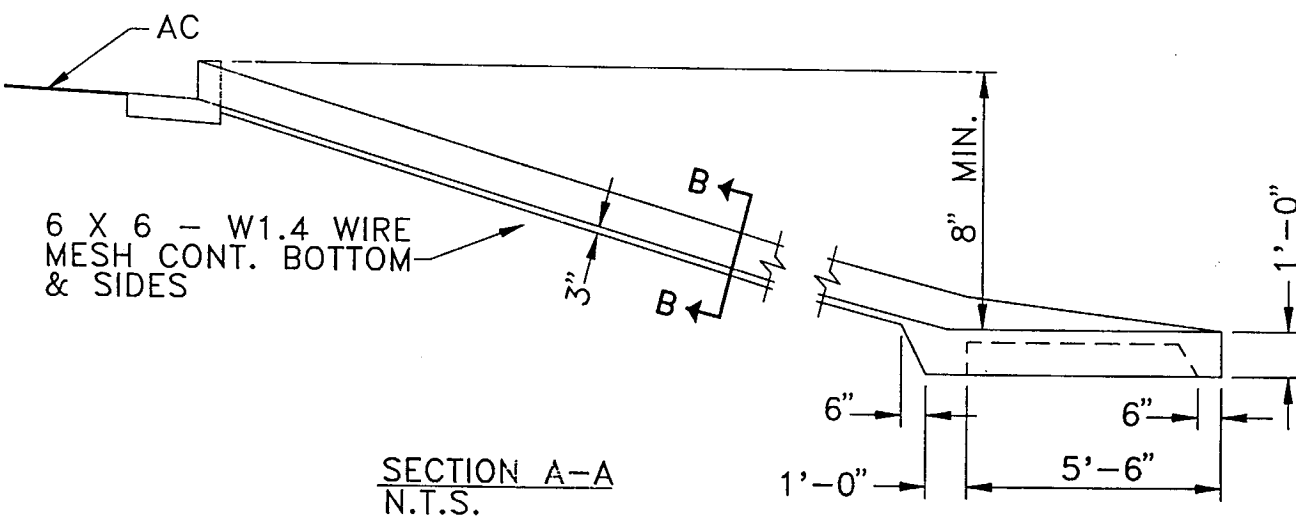
CONCRETE SHALL BE FINISHED BY MEANS OF FLOAT, THEN THEN TROWELLED, AND THEN BROOMED WITH A FINE BRUSH IN TRANSVERSE DIRECTION.

## DRIVEWAY ENTRANCE

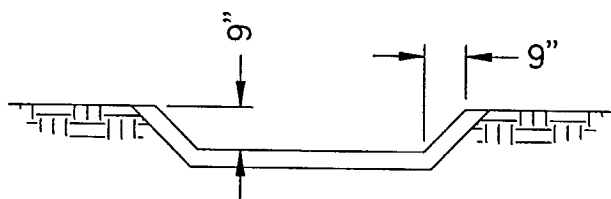
DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	DRIVEWAY ENTRANCE DETAIL	CHECKED BY	J. BARKER	DETAIL NO DM-C 016
		SCALE	NONE	
		DATE	15 JUN 95	



PLAN  
N.T.S.



SECTION A-A  
N.T.S.

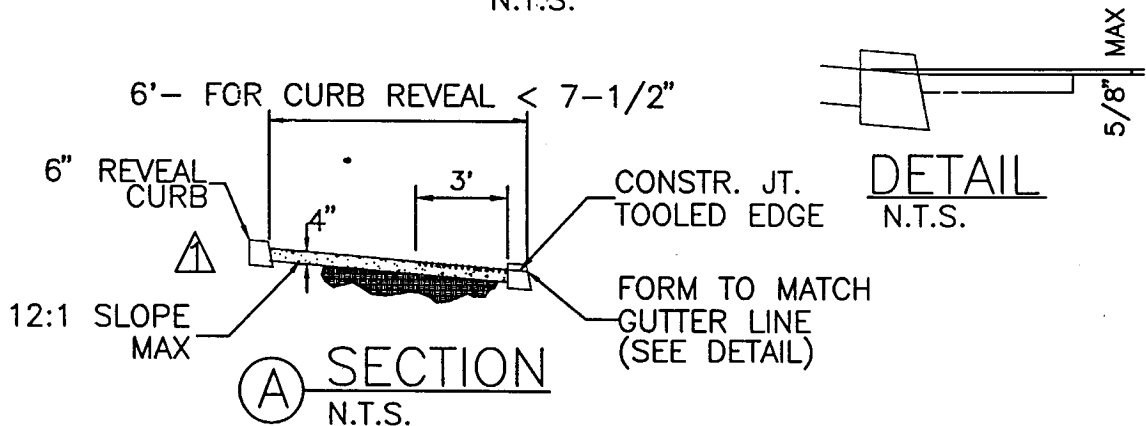
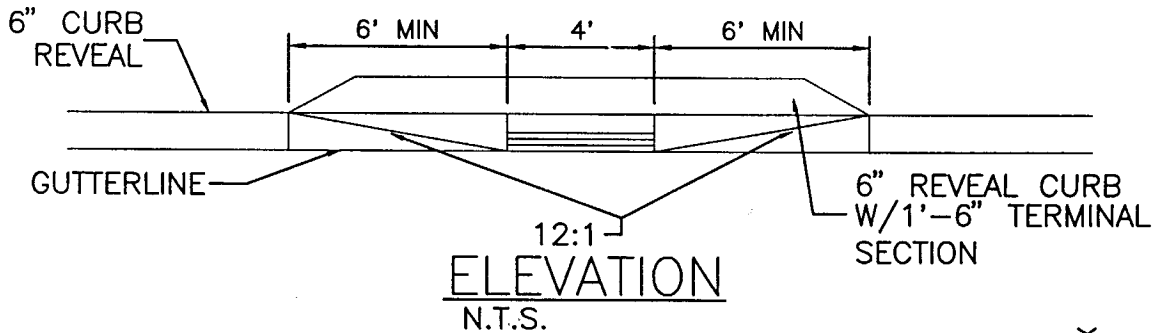
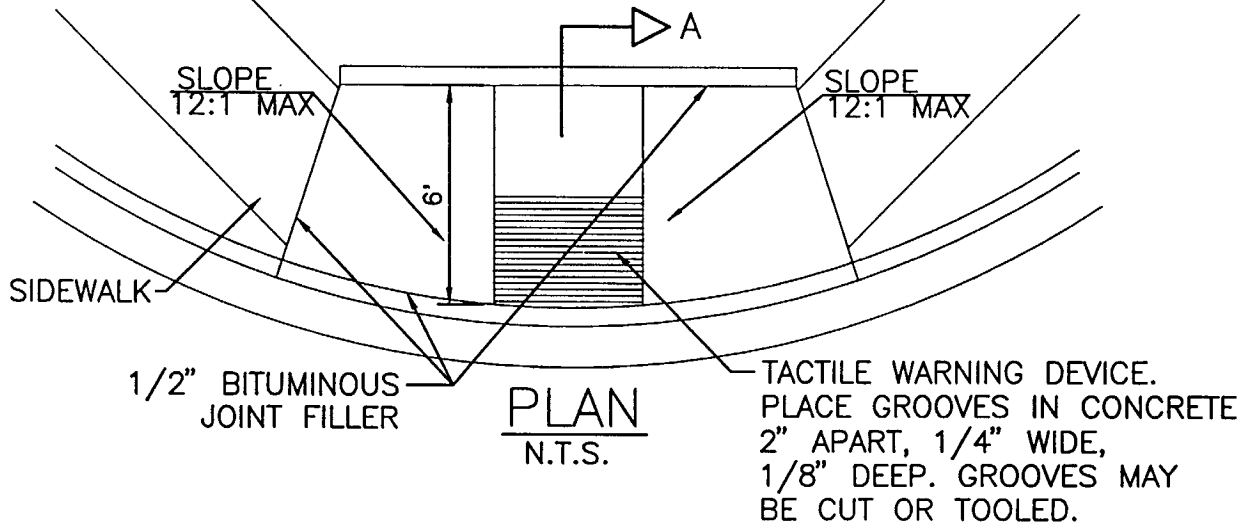


SECTION B-B  
N.T.S.

## SPILLWAY

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	SPILLWAY DETAIL	CHECKED BY	J. BARKER	DETAIL NO DM-C 024
		SCALE	NONE	
		DATE	15 JUN 95	

NOTE: IF SITE CONDITIONS  
DICTATE DEVIATIONS FROM STD.  
DETAIL, COORDINATE W/ AGENCY

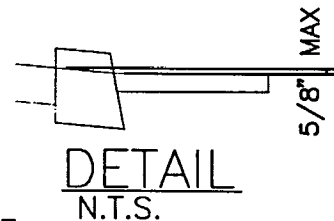
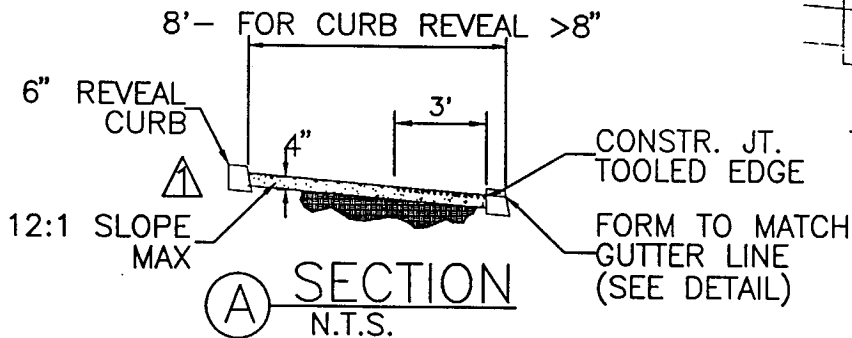
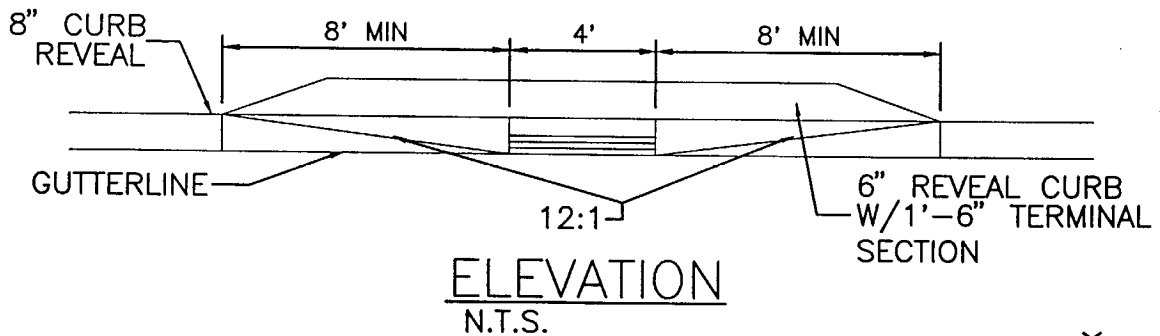
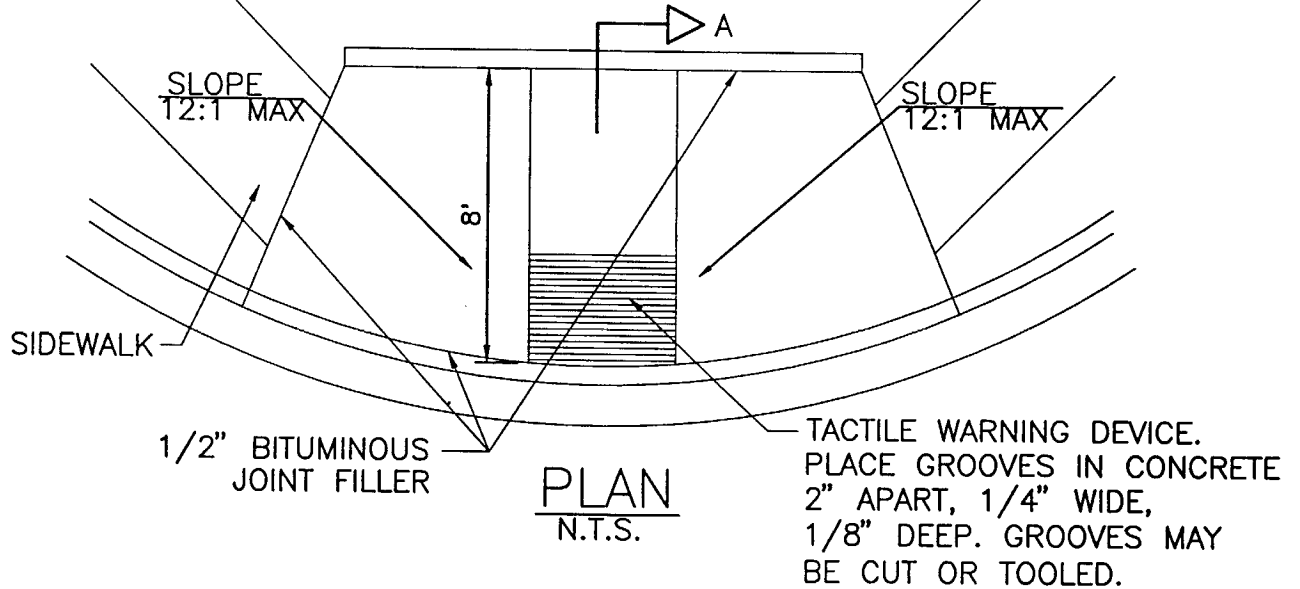


⚠ 6" REVEAL CURB REQUIRED ONLY WHEN NOTED ON  
THE PLANS TO RESTRICT VEHICULAR TRAFFIC.  
VERIFY NEED; DELETE IF NOT APPLICABLE

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	6' REVEAL CURB DETAIL	CHECKED BY	J. BARKER	DETAIL NO DM-C 25A
		SCALE	NONE	
		DATE	15 JUN 95	



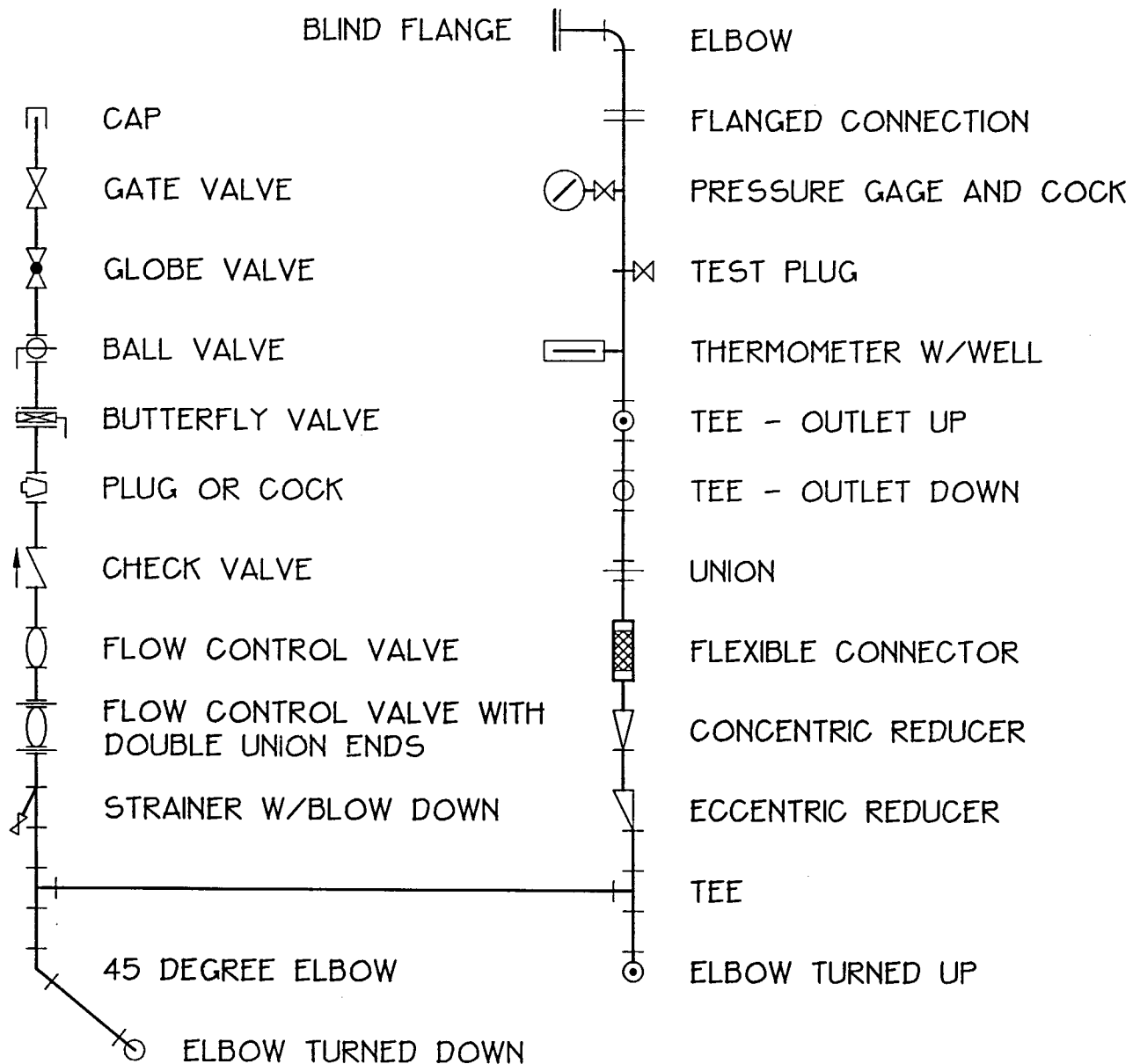
NOTE: IF SITE CONDITIONS  
DICTATE DEVIATIONS FROM STD.  
DETAIL, COORDINATE W/ AGENCY



⚠ 6" REVEAL CURB REQUIRED ONLY WHEN NOTED ON THE PLANS TO RESTRICT VEHICULAR TRAFFIC. VERIFY NEED; DELETE IF NOT APPLICABLE

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND <b>DAVIS-MONTHAN AFB, AZ</b> CIVIL ENGINEER OFFICE	<b>8' REVEAL CURB DETAIL</b>	CHECKED BY <b>J. BARKER</b> SCALE <b>NONE</b> DATE <b>15 JUN 95</b>	DETAIL NO <b>DM-C 25B</b>
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# HYDRONIC SYMBOLS



DEPARTMENT OF THE AIR FORCE  
AIR COMBAT COMMAND

DAVIS-MONTHAN AFB, AZ  
CIVIL ENGINEER OFFICE

HYDRONIC STANDARD  
SYMBOLS

CHECKED BY J. BARKER

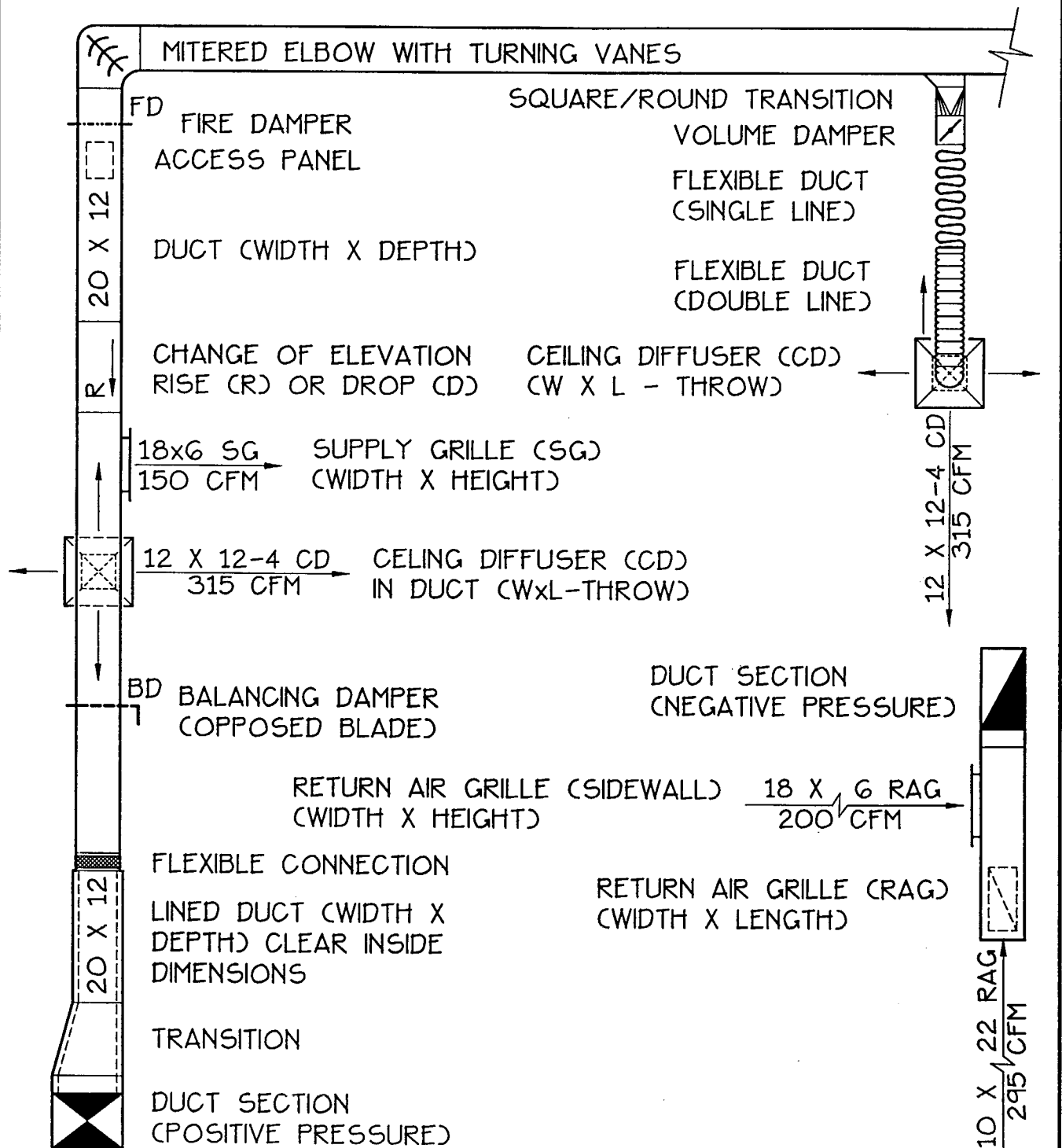
SCALE NONE

DATE 18 MAR 91

DETAIL NO

DM-M  
-001

# DUCTWORK SYMBOLS



DEPARTMENT OF THE AIR FORCE  
AIR COMBAT COMMAND

DAVIS-MONTHAN AFB, AZ  
CIVIL ENGINEER OFFICE

DUCTWORK STANDARD  
SYMBOLS

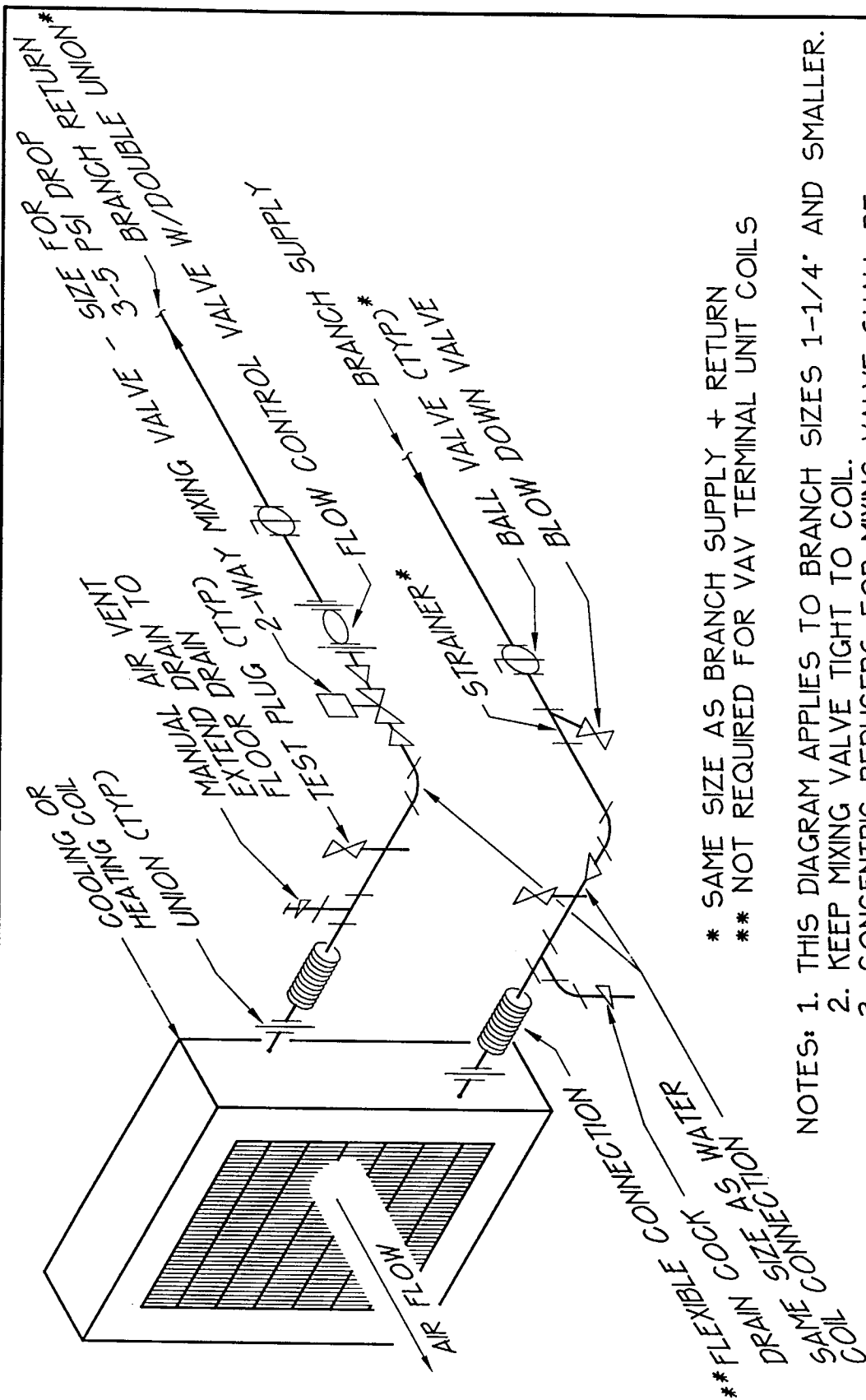
CHECKED BY J. BARKER  
SCALE NONE  
DATE 18 MAR 91

DETAIL NO  
DM-M  
-002







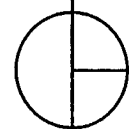


\* SAME SIZE AS BRANCH SUPPLY + RETURN  
 \*\* NOT REQUIRED FOR VAV TERMINAL UNIT COILS

- NOTES:
1. THIS DIAGRAM APPLIES TO BRANCH SIZES 1-1/4" AND SMALLER.
  2. KEEP MIXING VALVE TIGHT TO COIL.
  3. CONCENTRIC REDUCERS FOR MIXING VALVE SHALL BE LOCATED WITHIN SIX INCHES OF THE VALVE.
  4. ALL VALVES AND STRAINER SHALL HAVE THREADED CONNECTIONS.

# TYPICAL WATER COIL PIPING DIAGRAM

NOT TO SCALE



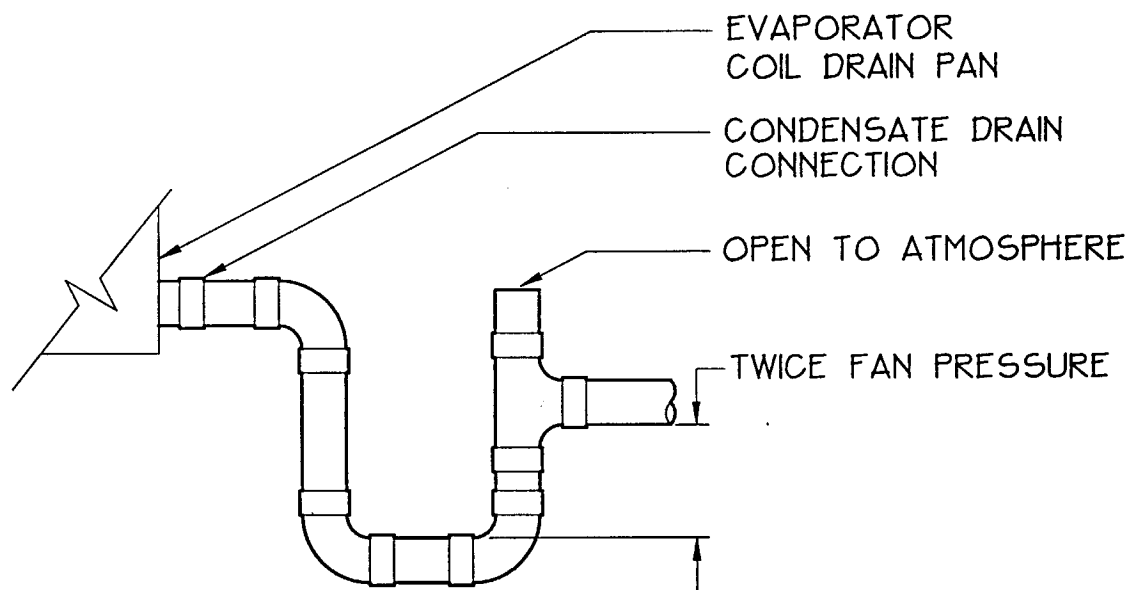
DEPARTMENT OF THE AIR FORCE  
 AIR COMBAT COMMAND  
 DAVIS-MONTHAN AFB, AZ  
 CIVIL ENGINEER OFFICE

## TYPICAL WATER COIL PIPING DIAGRAM

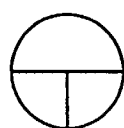
CHECKED BY J. BARKER  
 SCALE NONE  
 DATE R1 15 APR 92

DETAIL NO  
 DM-M  
 005

# CONDENSATE DRAIN DETAIL



NOTE: MINIMUM SIZE OF CONDENSATE DRAIN SHALL BE SIZE OF CONDENSATE DRAIN CONNECTION.

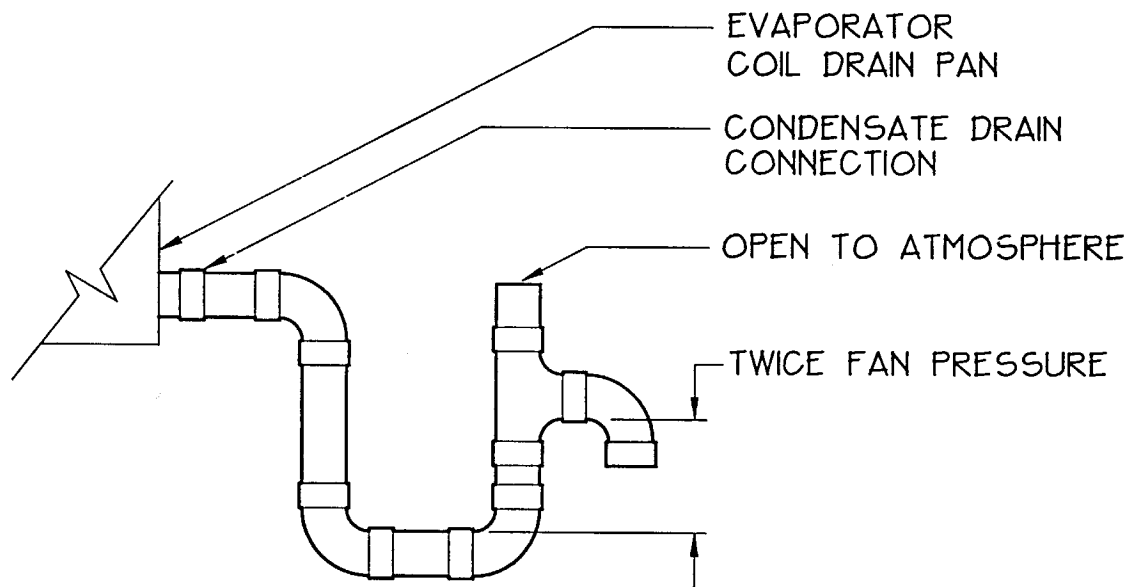


## CONDENSATE DRAIN DETAIL

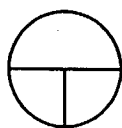
NOT TO SCALE

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	CONDENSATE DRAIN DETAIL	CHECKED BY J. BARKER	DETAIL NO DM-M 006
		SCALE NONE	
		DATE 25 MAR 91	

# CONDENSATE DRAIN DETAIL



NOTE: MINIMUM SIZE OF CONDENSATE DRAIN SHALL BE SIZE OF CONDENSATE DRAIN CONNECTION.



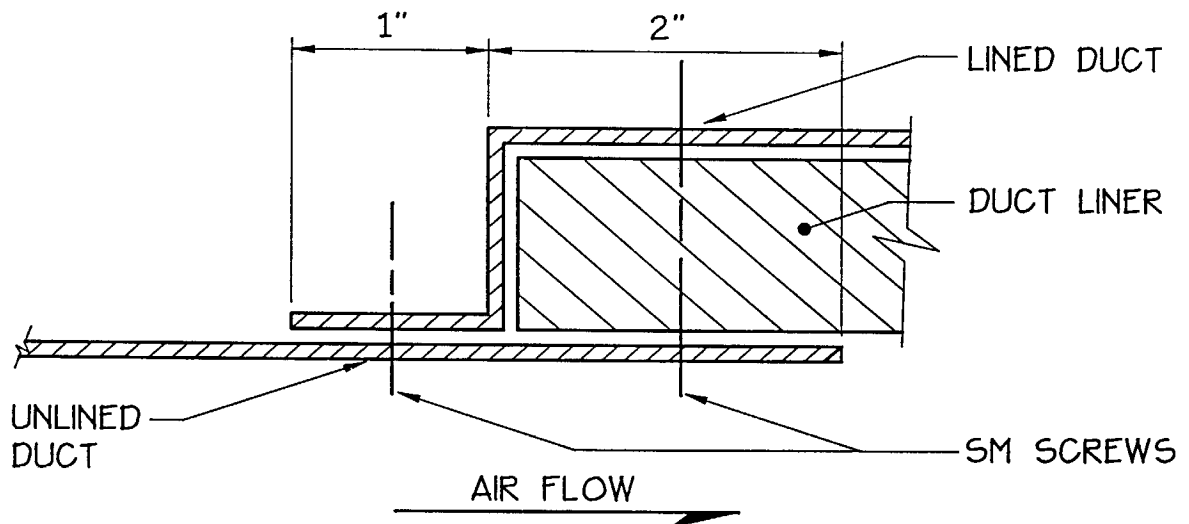
## CONDENSATE DRAIN DETAIL

NOT TO SCALE

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	CONDENSATE DRAIN DETAIL	CHECKED BY J. BARKER	DETAIL NO DM-M 007
		SCALE NONE	
		DATE 25 MAR 91	



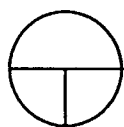
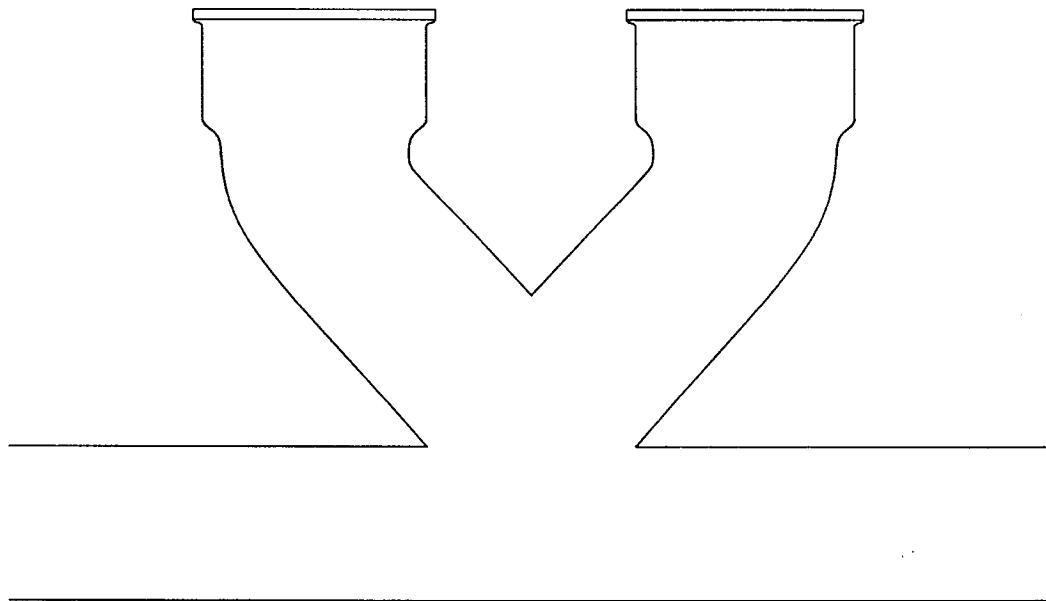
# INTERNAL DUCT LINER DETAIL



INTERNAL DUCT LINER DETAIL  
NOT TO SCALE

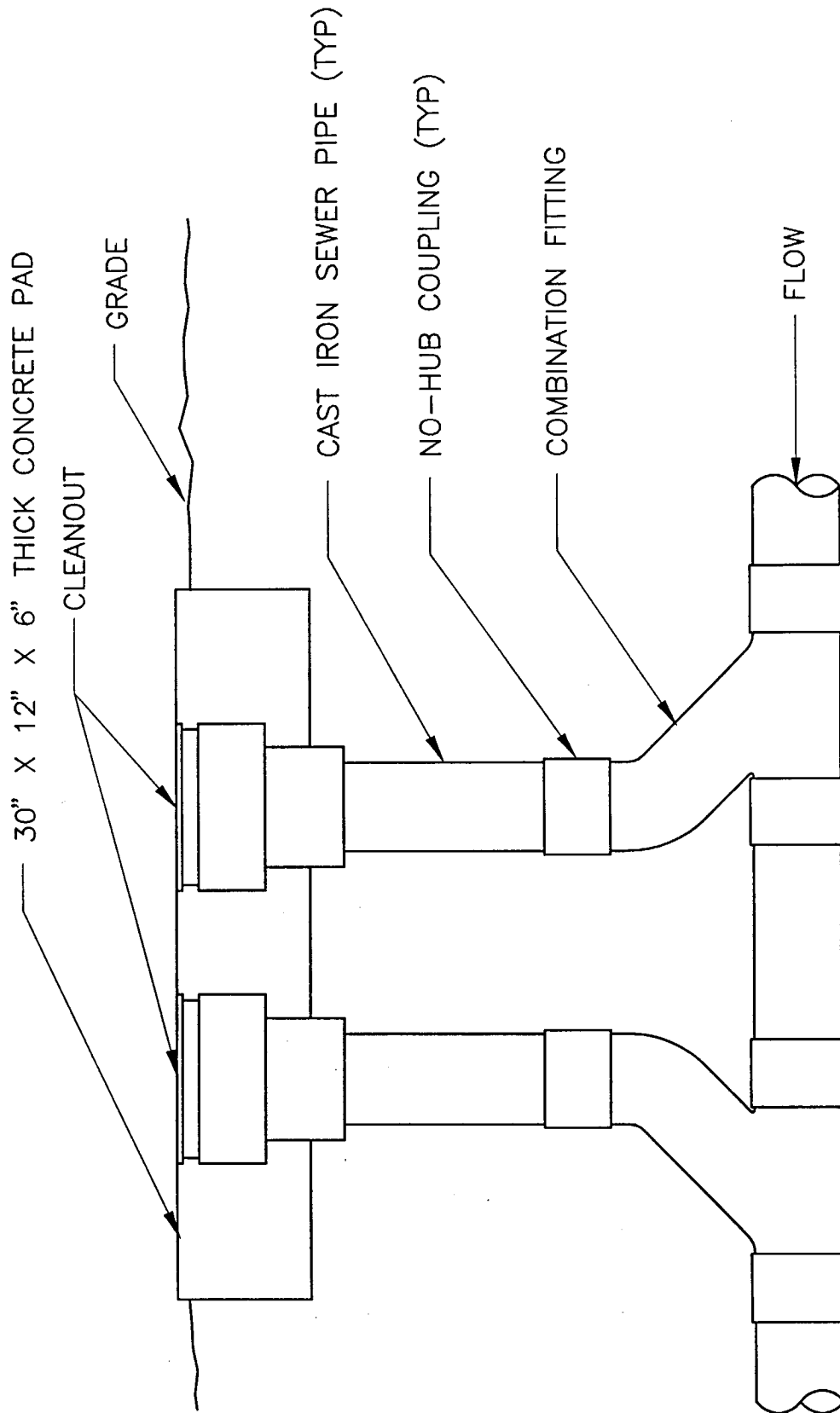
DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	INTERNAL DUCT LINER DETAIL	CHECKED BY	J. BARKER	DETAIL NO DM-M 008
		SCALE	NONE	
		DATE	25 MAR 91	

# TWO-WAY CLEANOUT DETAIL



TWO-WAY CLEANOUT DETAIL  
NOT TO SCALE

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND	TWO-WAY CLEANOUT DETAIL	CHECKED BY J. BARKER	DETAIL NO
DAVIS-MONTHAN AFB, AZ		SCALE NONE	DM-M
CIVIL ENGINEER OFFICE		DATE 25 MAR 91	009



⊕ TYPICAL TWO-WAY CLEANOUT DETAIL  
NOT TO SCALE

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND	TYPICAL TWO-WAY CLEANOUT DETAIL	CHECKED BY J. BARKER	DETAIL NO DM-M 010
DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE		SCALE NONE	
		DATE 26 MAY 92	

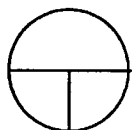
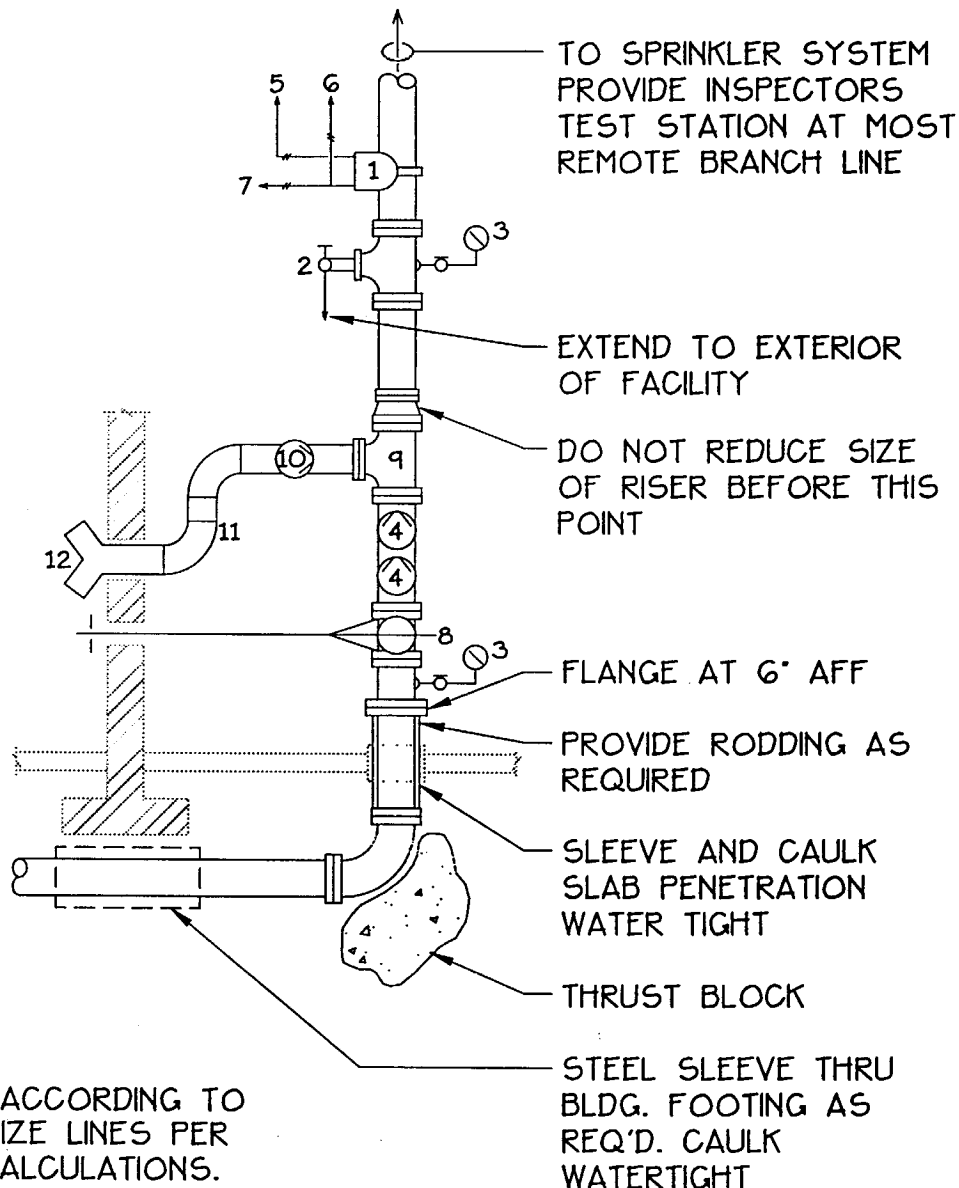
# FIRE PROTECTION RISER DIAGRAM

## WET PIPE RISER SCHEDULE

1. PROVIDE PADDLE TYPE WATER FLOW INDICATOR
2. MAIN DRAIN
3. PRESSURE GAUGE
4. SUPPLY LINE U.L. LISTED DOUBLE CHECK BACKFLOW PREVENTOR
5. LOCAL ALARM CIRCUIT
6. TRANSMITTED ALARM CIRCUIT
7. POWER SUPPLY CIRCUIT
8. THRU WALL INDICATING SERVICE SHUT-OFF VALVE W/ VALVE TAMPER SWITCH
9. TEE FOR FIRE DEPT. CONNECTION
10. CHECK VALVE
11. SUPPLY FROM SIAMESE FIRE DEPT. CONNECTION
12. FIRE DEPT. CONNECTION

### NOTE:

INSTALL WET PIPE SYSTEMS ACCORDING TO NFPA - 13, 231 + 231C. SIZE LINES PER CONTRACTOR'S HYDRAULIC CALCULATIONS.



## FIRE PROTECTION RISER DIAGRAM

NOT TO SCALE

DEPARTMENT OF THE AIR FORCE  
AIR COMBAT COMMAND

DAVIS-MONTHAN AFB, AZ  
CIVIL ENGINEER OFFICE

FIRE PROTECTION  
RISER DIAGRAM

CHECKED BY C. ELLIS

SCALE NONE

DATE 11 JAN 95

DETAIL NO

DM-M  
011



# STANDARD HYDRONIC PIPE SIZES

MINIMUM GPM	MAXIMUM GPM	PIPE SIZE
0	1	1/2"
1	2-1/2	3/4"
2-1/2	5	1"
5	8	1-1/4"
8	15	1-1/2"
15	25	2"
25	45	2-1/2"
45	80	3"
80	150	4"
150	300	6"
300	550	8"
550	800	10"
800	1,000	12"

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	STANDARD HYDRONIC PIPE SIZES	CHECKED BY	J. BARKER	DETAIL NO DM-5 001
		SCALE	NONE	
		DATE	20 MAR 91	

# STANDARD FLEXIBLE DUCT SIZES

DUCT SIZE		CFM RANGE
*	3"	UP TO 15 CFM
*	4"	20 - 30 CFM
*	5"	35 - 50 CFM
	6"	55 - 85 CFM
*	7"	90 - 120 CFM
	8"	125 - 180 CFM
*	9"	185 - 220 CFM
	10"	215 - 315 CFM
	12"	320 - 425 CFM
	14"	430 - 545 CFM
	16"	550 - 730 CFM
	18"	735 - 900 CFM

**\* OPTIONAL USE**

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	STANDARD FLEXIBLE DUCT SIZES	CHECKED BY J. BARKER	DETAIL NO
		SCALE NONE	DM-5
		DATE 20 MAR 91	002

# STANDARD RETURN AIR GRILLE SIZES

USE	GRILLE SIZE	CFM RANGE
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T-BAR	10 X 22	UP TO 600
CEILING	22 X 22	605 - 1250

HARD CEILINGS	6 X 6	UP TO 95
	8 X 8	100 - 170
	10 X 10	175 - 270
	12 X 12	275 - 395
	12 X 24	400 - 600
	24 X 24	605 - 1400

SIDEWALL	SIZE INDIVIDUALLY
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DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND	STANDARD RETURN AIR GRILLE SIZES	CHECKED BY J. BARKER	DETAIL NO
DAVIS-MONTHAN AFB, AZ		SCALE NONE	DM-5
CIVIL ENGINEER OFFICE		DATE 20 MAR 91	003

# FACILITY HVAC MATRIX

KEY

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* PREFERRED SYSTEM
A ALTERNATE SYSTEM
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DX COOLING/GAS HEATING PACKAGED UNIT - SINGLE COMPRESSOR
DX COOLING/GAS HEATING PACKAGED UNIT - MULTIPLE COMPRESSOR
AIR-TO-AIR PACKAGED HEAT PUMP
WATER-TO-AIR PACKAGED HEAT PUMP
AIR-COOLED CHILLER - SINGLE COMPRESSOR
AIR-COOLED CHILLER - MULTIPLE COMPRESSOR
EVAPORATIVE-COOLED ROTARY COMPRESSOR PACKAGED CHILLER
WATER-COOLED ROTARY COMPRESSOR CHILLER
WATER-COOLED RECIPROCATING CHILLER - MULTIPLE CHILLER
FORCED-DRAFT COOLING TOWER
INDUCED-DRAFT COOLING TOWER
CONSTANT VOLUME SINGLE ZONE AIR HANDLER
CONSTANT VOLUME MULTI-ZONE AIR HANDLER
VARIABLE VOLUME AIR HANDLER
NO ECONOMIZER - MINIMUM OUTSIDE AIR
DRY BULB MODULATING ECONOMIZER CYCLE
EVAPORATIVE COOLING
GAS-FIRED CAST IRON BOILER
GAS-FIRED FORCED AIR FURNACE
GAS-FIRED UNIT HEATERS
TWO-PIPE UNIT HEATERS

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LESS THAN 7-1/2 TONS
7-1/2 - 12-1/2 TONS
15 - 19 TONS
20 - 39 TONS
40 - 59 TONS
60 - 99 TONS
100 - 119 TONS
GREATER THAN 120 TONS

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*AΔ*
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SHOP AREAS (NO AC)

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REMOTE AREAS (NO GAS AVAIL)

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	FACILITY HVAC MATRIX	CHECKED BY	J. BARKER	DETAIL NO DM-5 004
		SCALE	NONE	
		DATE	21 MAR 91	



# KRUEGER CEILING DIFFUSER SIZES

**MODEL 1240P - 4 WAY - NC 30**

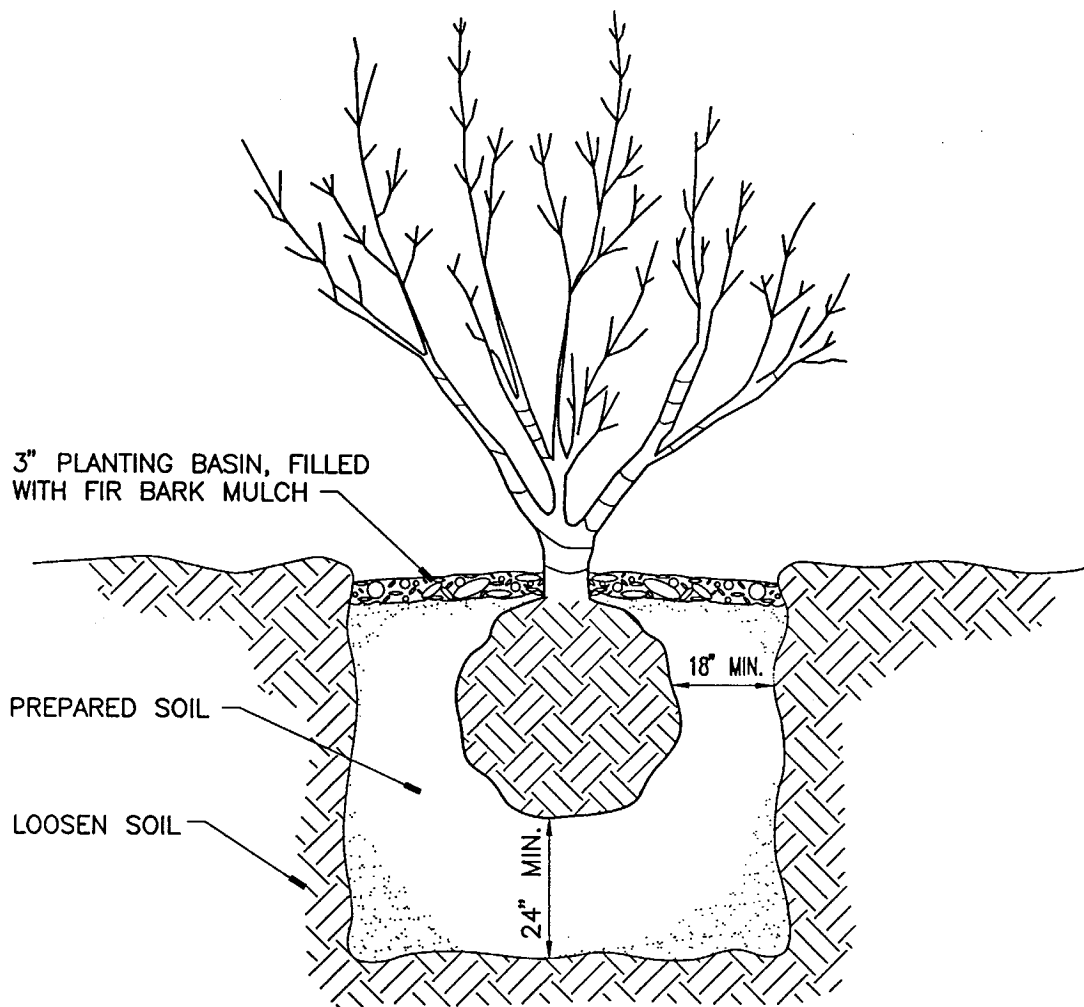
<b>DIFFUSER SIZE</b>	<b>MAX CFM</b>	<b>THROW FT</b>	<b>FLEX HOSE SIZE</b>
6 X 6	85	5'	6"
8 X 8	180	6'	8"
10 X 10	315	10'	10"
12 X 12	425	11'	12"
14 X 14	545	13'	14"
16 X 16	730	14'	16"
18 X 18	900	15'	18"

DEPARTMENT OF THE AIR FORCE  
AIR COMBAT COMMAND  
DAVIS-MONTHAN AFB, AZ  
CIVIL ENGINEER OFFICE

KRUEGER CEILING  
DIFFUSER SIZES

CHECKED BY J. BARKER  
SCALE NONE  
DATE 19 JUN 91

DETAIL NO  
DM-5  
005

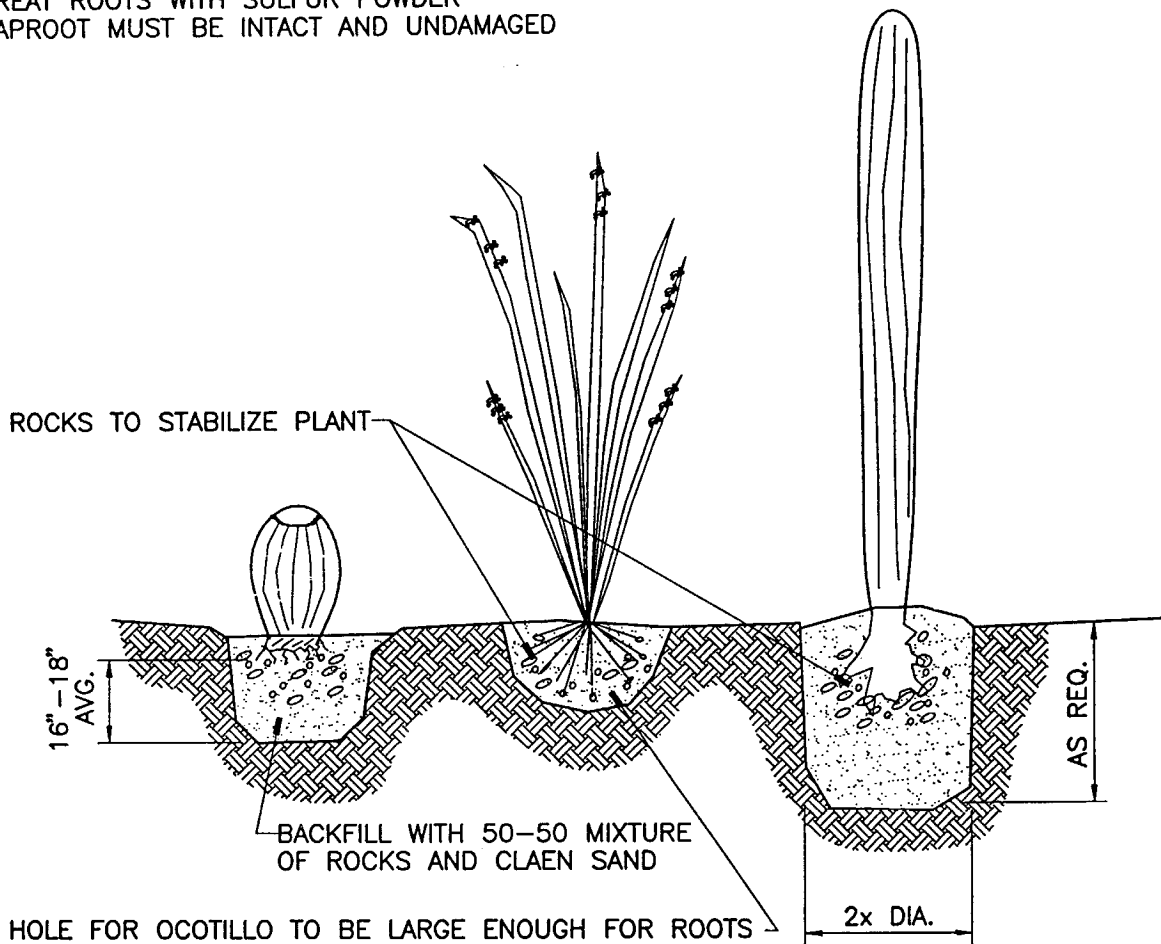


# NON-NATIVE SHRUB PLANTING

NTS

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	NON-NATIVE SHRUB PLANTING		CHECKED BY	D. SPEER	DETAIL NO DM-L 019
			SCALE	AS SHOWN	
			DATE	11 JAN 96	

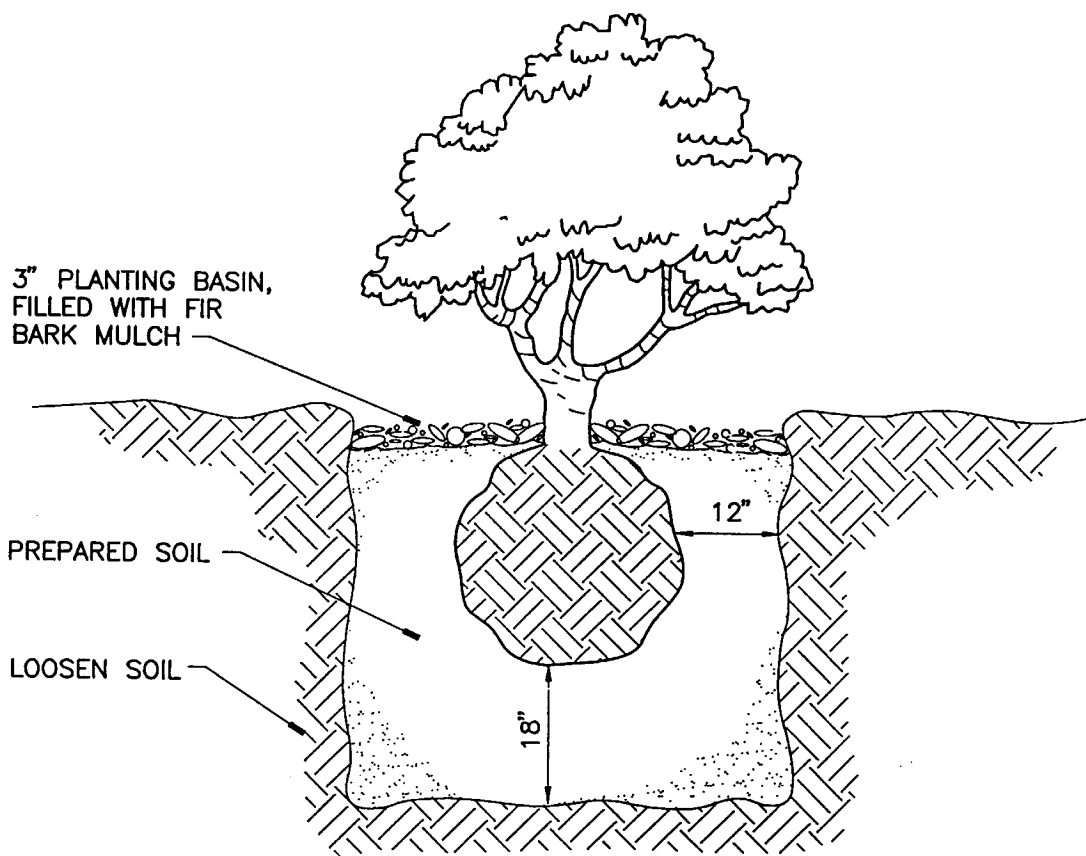
- PLACE PLANT IN ORIGINAL ORIENTATION
- TREAT ROOTS WITH SULFUR POWDER
- TAPROOT MUST BE INTACT AND UNDAMAGED



## CACTUS PLANTING

NTS

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	CACTUS PLANTING	CHECKED BY D. SPEIR	DETAIL NO DM-L 020
		SCALE AS SHOWN	
		DATE 11 JAN 96	

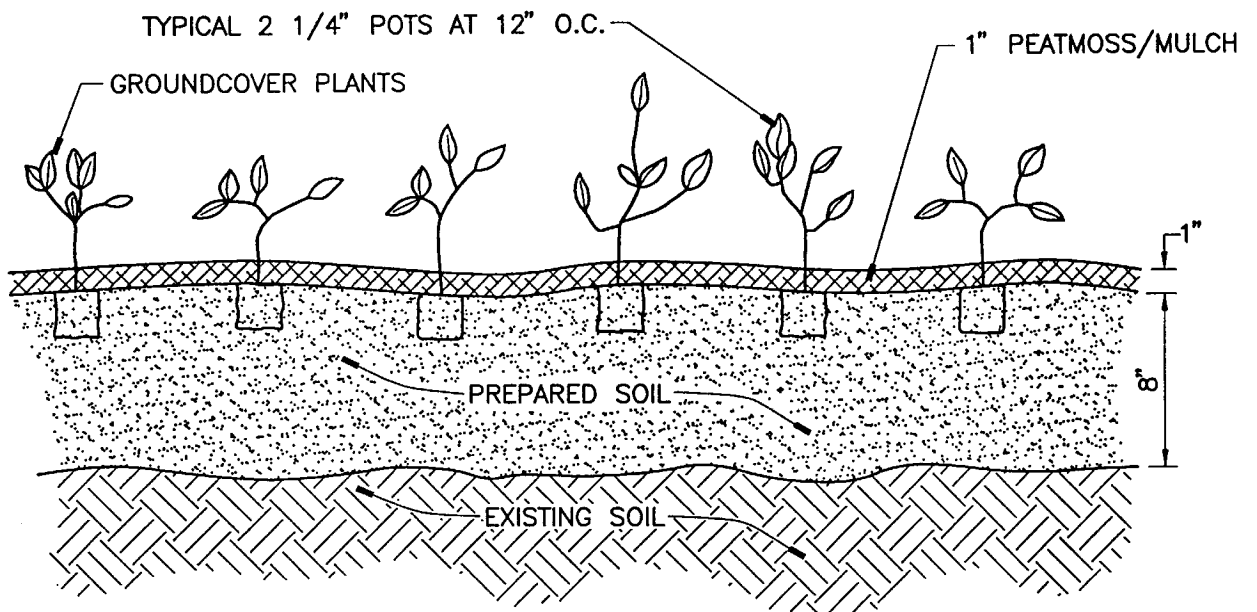


# NATIVE SHRUB PLANTING

NTS

DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	NATIVE SHRUB PLANTING	CHECKED BY	D. SPEIR	DETAIL NO DM-L 022
		SCALE	AS SHOWN	
		DATE	11 JAN 96	

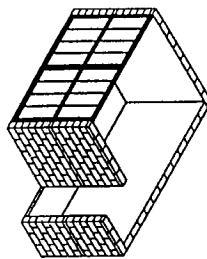
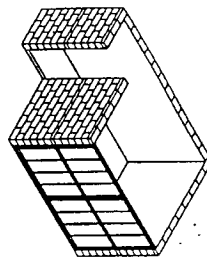




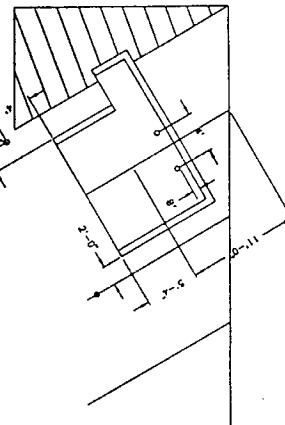
# GROUND COVER PLANTING

NTS

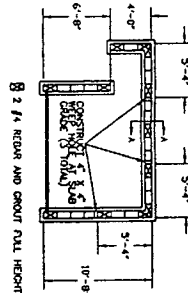
DEPARTMENT OF THE AIR FORCE AIR COMBAT COMMAND DAVIS-MONTHAN AFB, AZ CIVIL ENGINEER OFFICE	GROUND COVER PLANTING	CHECKED BY	D. SPEIR	DETAIL NO DM-L 023
		SCALE	AS SHOWN	
		DATE	11 JAN 96	



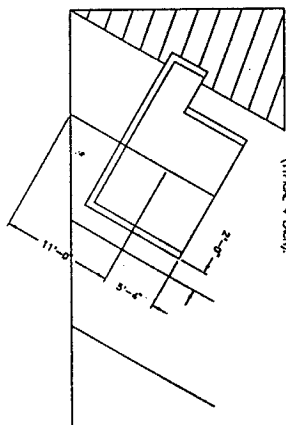
ISOMETRIC VIEW



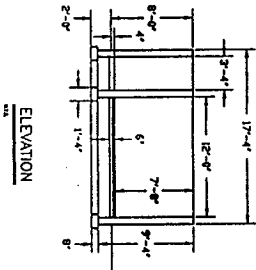
PLAN



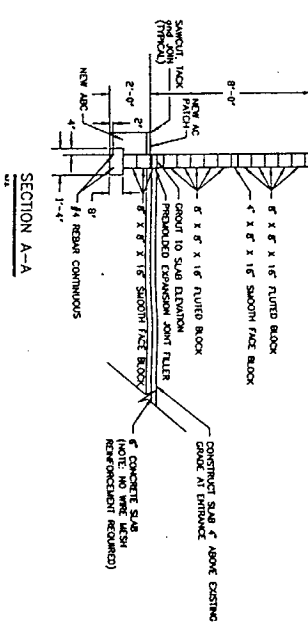
PLAN



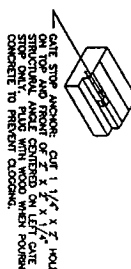
STING PLAN



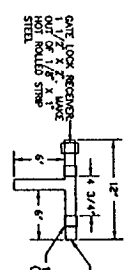
ELEVATION



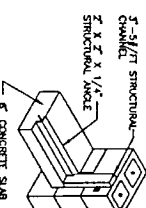
SECTION A-A



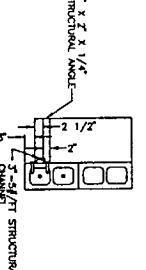
GATE STOP ANCHOR



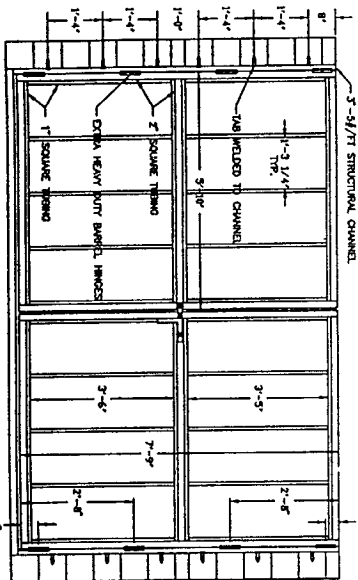
GATE LOCK DETAIL



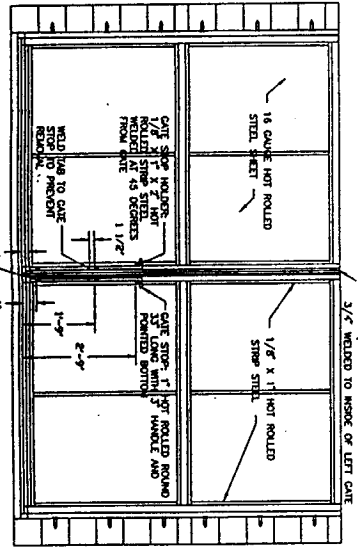
GATE MOUNTING DETAIL



GATE MOUNTING DETAIL-PLAN



GATE ELEVATION (OUTSIDE)



GATE ELEVATION (INSIDE)

1. STING SHALL BE ACCOMPANIED BY ONE ENGINEERING DESIGN SECTION, AS11A.
2. SLAB SHALL SLOPE IN SAME DIRECTION AS PARKING LOT AND DRAIN TO WEIR HOLES.
3. DRAIN TO SLAB ELEVATION ON ALL WALLS, EXCEPT AS NOTED.
4. ALL BLOCK SHALL BE TERRA BROWN INTERIOR COLORED SPLIT FACED FLUTED CURB OR SMOOTH FACED CURB, AS NOTED. MORTAR TO MATCH COLOR OF CURB.
5. CONSTRUCT CHECKER ON SIDE WITH HIGHEST ELEVATION TO PROVIDE POSITIVE DRAINAGE AROUND STRUCTURE. CHECKER SHALL BE 1 FOOT WIDE AT WIDEST POINT AND 1 1/2" ABOVE EXISTING GRADE AT HIGH POINT. CHECKER SHALL BE 2" THICK CONCRETE.
6. YIELD SIX 2" X 2" X 1/4" THICK TIES ON EACH SIDE OF 3'-3 3/4" STRUCTURAL CHANNEL.
7. EXTRA HEAVY DUTY BARREL HINGES SHALL BE 1" DIA. ROLLERS WITH 2" X 5" X 1/4" THICK TIE HINGERS SHALL BE CHECKED AFTER INSTALLATION.
8. ALL SQUARE TURNING SHALL BE 18 GAUGE.
9. ON GATE, WELD 1" SQUARE TURNING FLUSH TO FACE OF 2" SQUARE TURNING.
10. INSTALL 18 GAUGE STEEL SHEET ON INSIDE OF GATE. MOUNT TO 1" SQUARE TURNING WITH 3/8" SHEET METAL SCREWS THROUGH 1/8" X 1" STRIP STEEL.
11. ALL METAL SHALL BE CLEANED BEFORE PAINT PROHIBITION PRIME COAT IS APPLIED.
12. ALL METAL SHALL BE PAINTED MEDIUM BROWN TO MATCH COLOR OF CURB.

NOTES

NO.	REVISION	DATE	BY	CHKD.
1	ISSUED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
2	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
3	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
4	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
5	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
6	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
7	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
8	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
9	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
10	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
11	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
12	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
13	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
14	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
15	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
16	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
17	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
18	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
19	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS
20	REVISED FOR PERMIT	10/1/00	W. J. HARRIS	W. J. HARRIS